NASA AT THE JOHN F. KENNEDY SPACE CENTER

PRICE: 25c

welcome...

I take great pleasure in welcoming you to John F. Kennedy Space Center.

The offices, laboratories, and launch complexes here represent an important phase of this nation's effort to achieve and maintain preeminence in all aspects of space research and exploration. We are proud of our part in this effort. Thousands of dedicated engineers, scientists, technicians, and support personnel here, both in government and industry, have labored ceaselessly to achieve many "firsts" in man's conquest of space. Their accomplishments confirm the total acceptance of the immense challenge of space exploration.

I sincerely hope you will share our pride in our facilities and our government-industry launch team.

Kurt H. Debus, Director
John F. Kennedy Space Center, NASA

Cape Kennedy from 105 miles above Earth, photographed by Gemini 4 astronauts.

history

The National Aeronautics and Space Administration was established October 1, 1958. This was 12 months after the launch of Sputnik 1, the first man-made Earth satellite, and nine months after the launch of Explorer 1, the first United States satellite.

The short history of NASA reflects the complex task of initiating and implementing a national space program among various government agencies, industry, and the scientific community, many of whose personnel and programs were already closely involved with space exploration.

The major focus of NASA's launch operations has centered on Cape Kennedy, formerly Cape Canaveral, Florida. The antecedents of these activities date back to the years following World War II when the War Department selected the site as a testing area for long-range guided missiles. This spit of land jutting into the Atlantic Ocean was selected because of the chain of islands stretching southeastward to Ascension Island which could accommodate tracking stations to measure the flight of research and development vehicles. The site was formally approved July 8, 1947.

Soon afterward, Congress authorized the acquisition and construction of the Atlantic Missile Range, now the Eastern Test Range. As a Department of Defense facility, the range was assigned to the Air Force for management. Subsequently, the range was extended to the Indian Ocean, a distance of more than 10,000 miles. In addition to the Air Force, the Army and Navy also have utilized the range facilities in the development of rocket-powered weapons systems.

As the NASA program got underway, concentrating on the peaceful exploration of outer space, the Cape became the headquarters of the Launch Operations Center, later renamed the John F. Kennedy Space Center, NASA. Also located on Cape Kennedy were field offices of NASA's Manned Spacecraft Center, Marshall Space Flight Center, Goddard Space Flight Center, and the Jet Propulsion Laboratory, the latter a spacecraft design agency supported by NASA. With the orderly growth of the space program, NASA has become the prime user of the range.

In late 1964, the NASA Kennedy Space Center was relocated on adjacent Merritt Island. The site, selected in 1961, occupies some 88,000 acres of land and water. Here, facilities have been installed to accommodate enormously powerful space vehicles to carry man to the Moon and back, and to undertake even more challenging missions in the vast reaches of the universe.

Apart from its future role as a stepping stone for manned exploration of the solar system, the Spaceport is rich in historical heritage.

Numerous Indian burial mounds and middens (refuse piles) have been discovered on NASA property. From some of these, researchers have removed artifacts dating back to the time of Christ. Elsewhere, and particularly along the Atlantic Ocean beaches, traces have been found of early Spanish activity.

Dr. Charles Fairbanks of the University of Florida has pointed out: "This was one of the areas where Western civilization came to the New World, and now it is the area from which our civilization will go forth to other worlds."

mission

JOHN F. KENNEDY SPACE CENTER is the major NASA launch organization for manned and unmanned space missions.

As the lead center within NASA for the development of launch philosophy, procedures, technology, and launch facilities, Kennedy Space Center launches manned Gemini and Apollo space vehicles; unmanned lunar, planetary, and interplanetary space vehicles; and scientific, meteorological, and communications satellites.

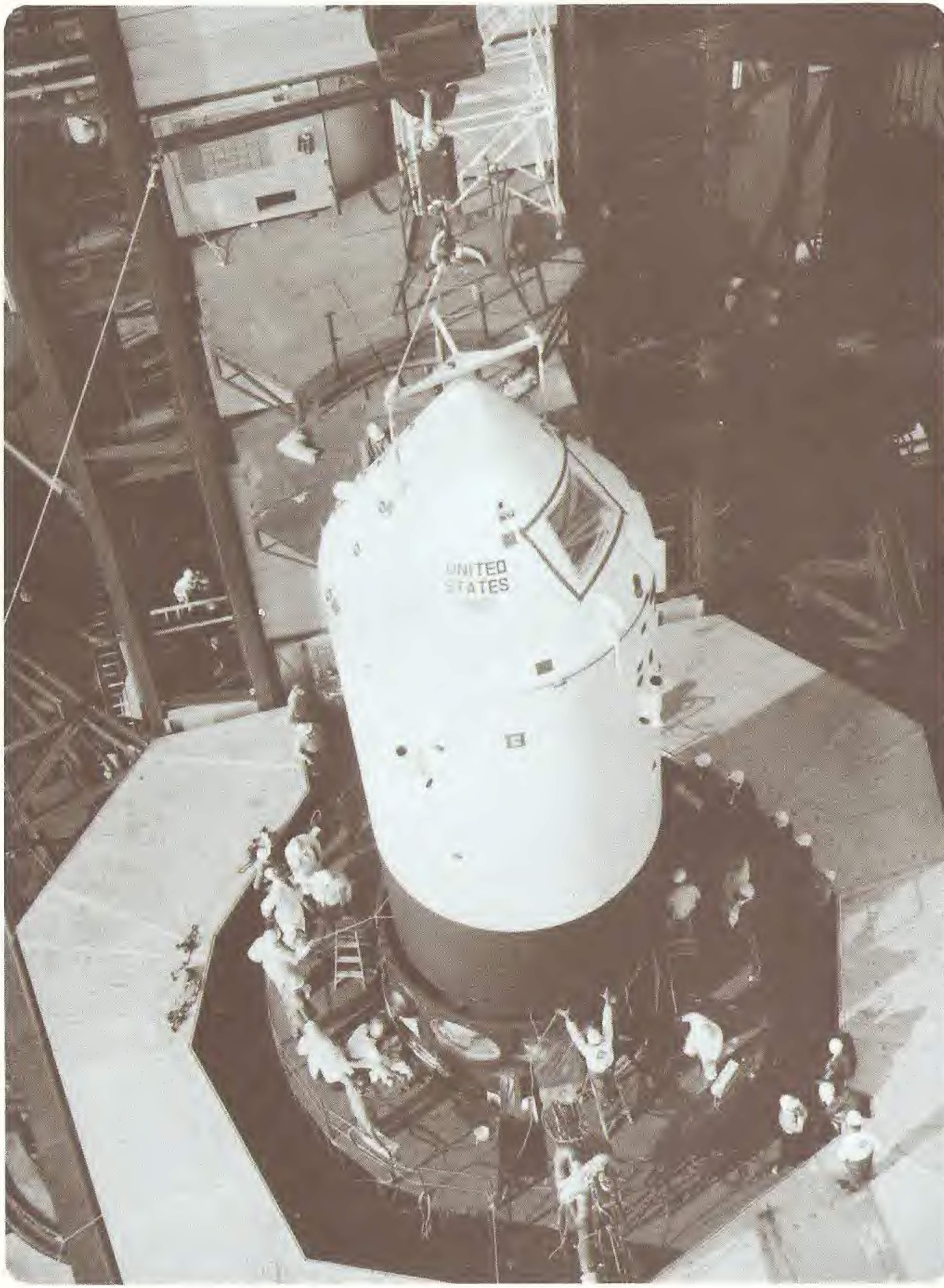
The mission encompasses planning and directing:

- Preflight Preparations
- Vehicle Integration
- Test and Checkout of Launch Vehicles, Spacecraft, and Facilities
- Coordination of Range Requirements
- Countdown and Launch Operations

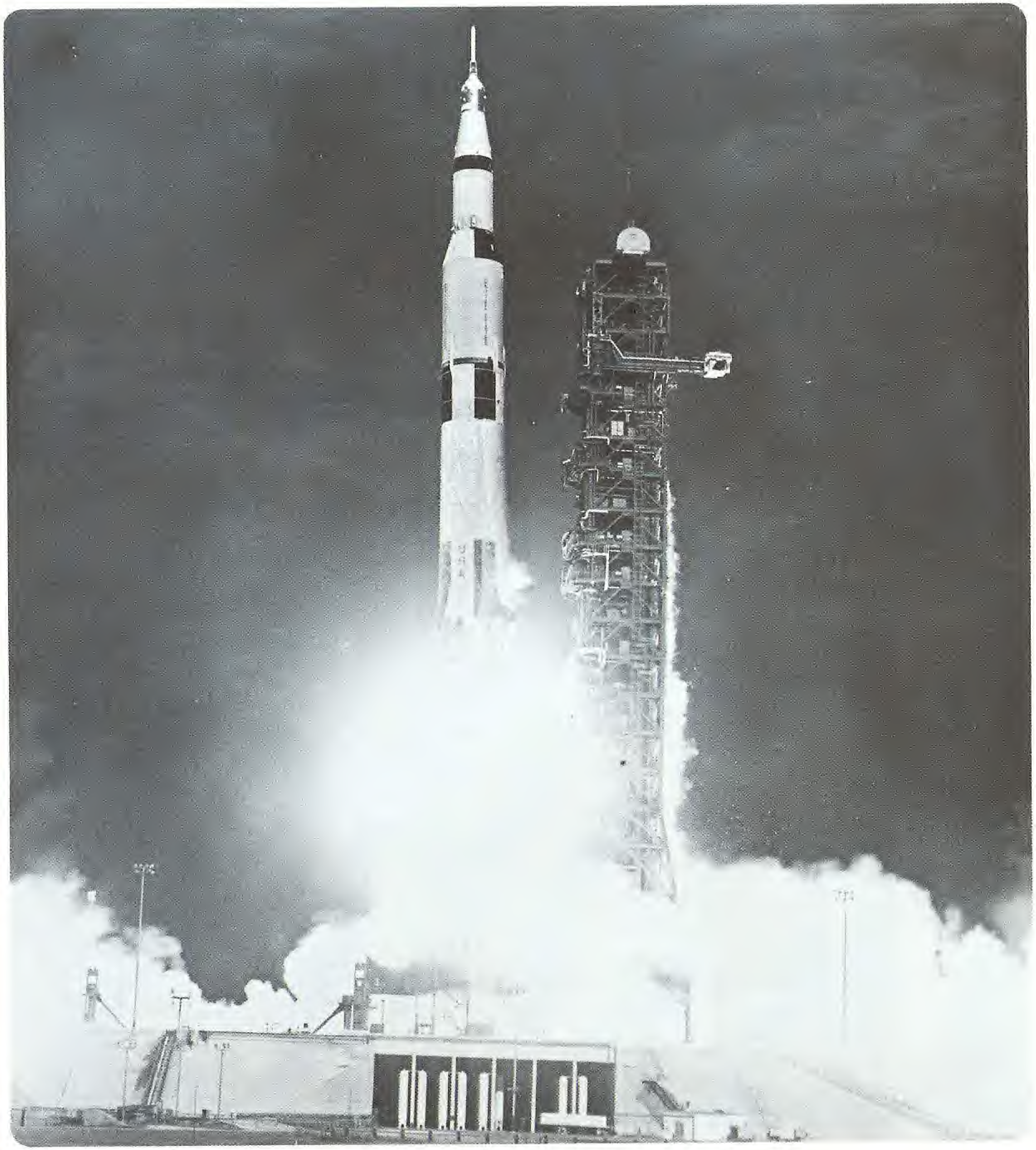
Supporting this primary mission are a host of technical and administrative activities. These include design engineering; testing, assembly, and checkout of launch vehicle and spacecraft; launch operations; and purchasing and contracting.

The national Spaceport at Kennedy Space Center is the site from which American astronauts will be launched on lunar exploration missions before the end of the decade.

THE AIR FORCE EASTERN TEST RANGE, part of the Air Force Systems Command, operates and maintains the largest missile proving ground in the world, one that spans 10,000 miles. The Test Range's mission is to provide launch facilities and support services for launching missiles and spacecraft, and gather useful data from the flights. The Range supports NASA-sponsored launches for the peaceful exploration of space.



Apollo spacecraft mated to upper stage of Saturn launch vehicle



Apollo/ Saturn V lifts off

launch vehicles

The United States space program depends on the ability of our scientists and engineers to provide the means for propelling useful payloads into Earth orbit and into the void of space. For this task, launch vehicles of a number of sizes and capabilities are necessary.

The flight path chosen for a payload determines what capabilities are required of the particular launch vehicle. Obviously, it would be impractical to use our most powerful launch vehicle, the Saturn V, to orbit a small, lightweight group of scientific satellites, or to risk failure of a mission by placing too much weight on a launch vehicle of any size.

For these reasons, the United States has developed a family of reliable launch vehicles of various sizes, shapes, and capabilities. This policy not only is economical, but it also increases overall reliability by providing more experience with several types of vehicles.

The aim is to develop the smallest number of vehicles consistent with the full scope of the space mission now foreseen.

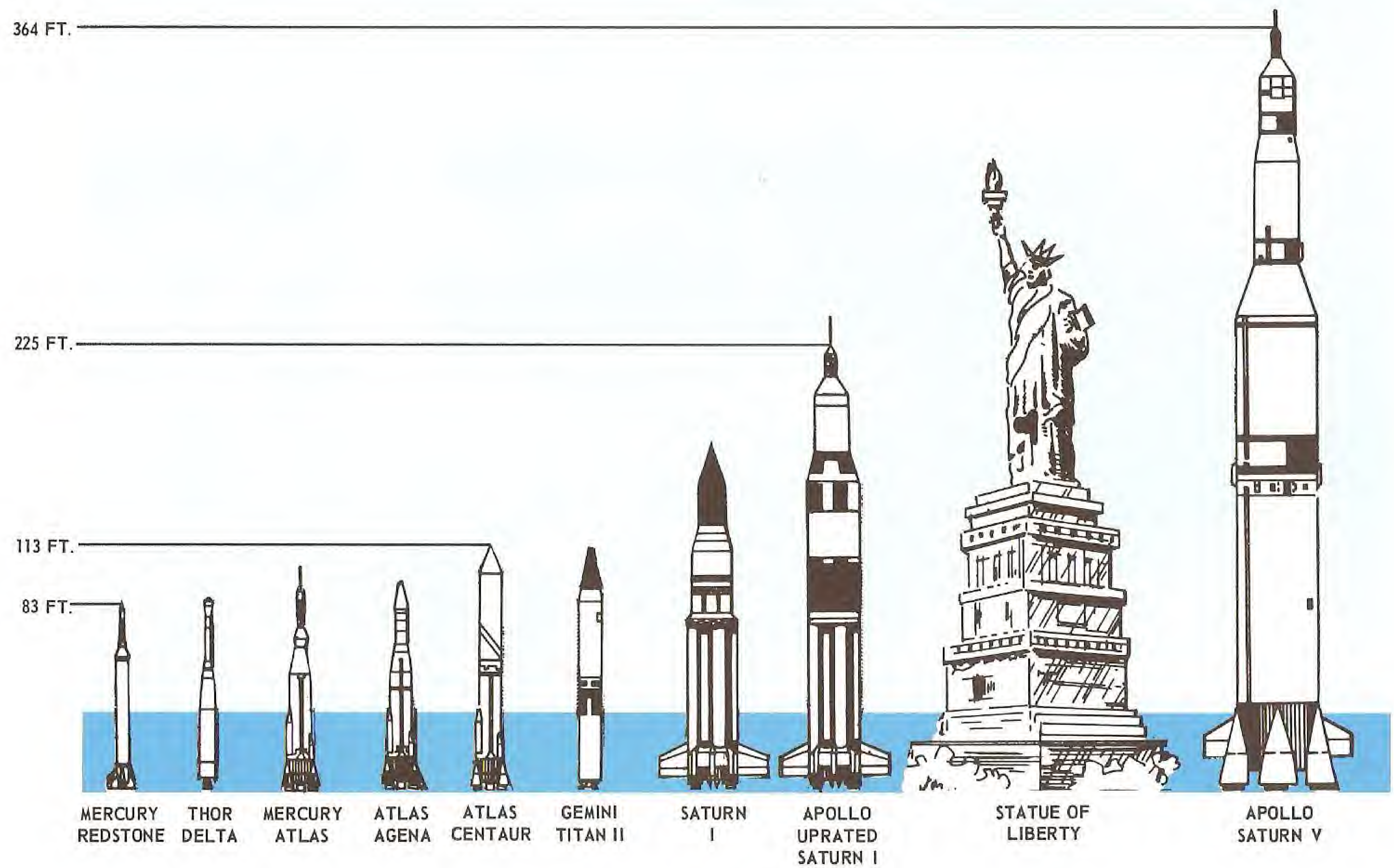
Launch vehicles used for space exploration missions at Cape Kennedy evolved principally from basic military

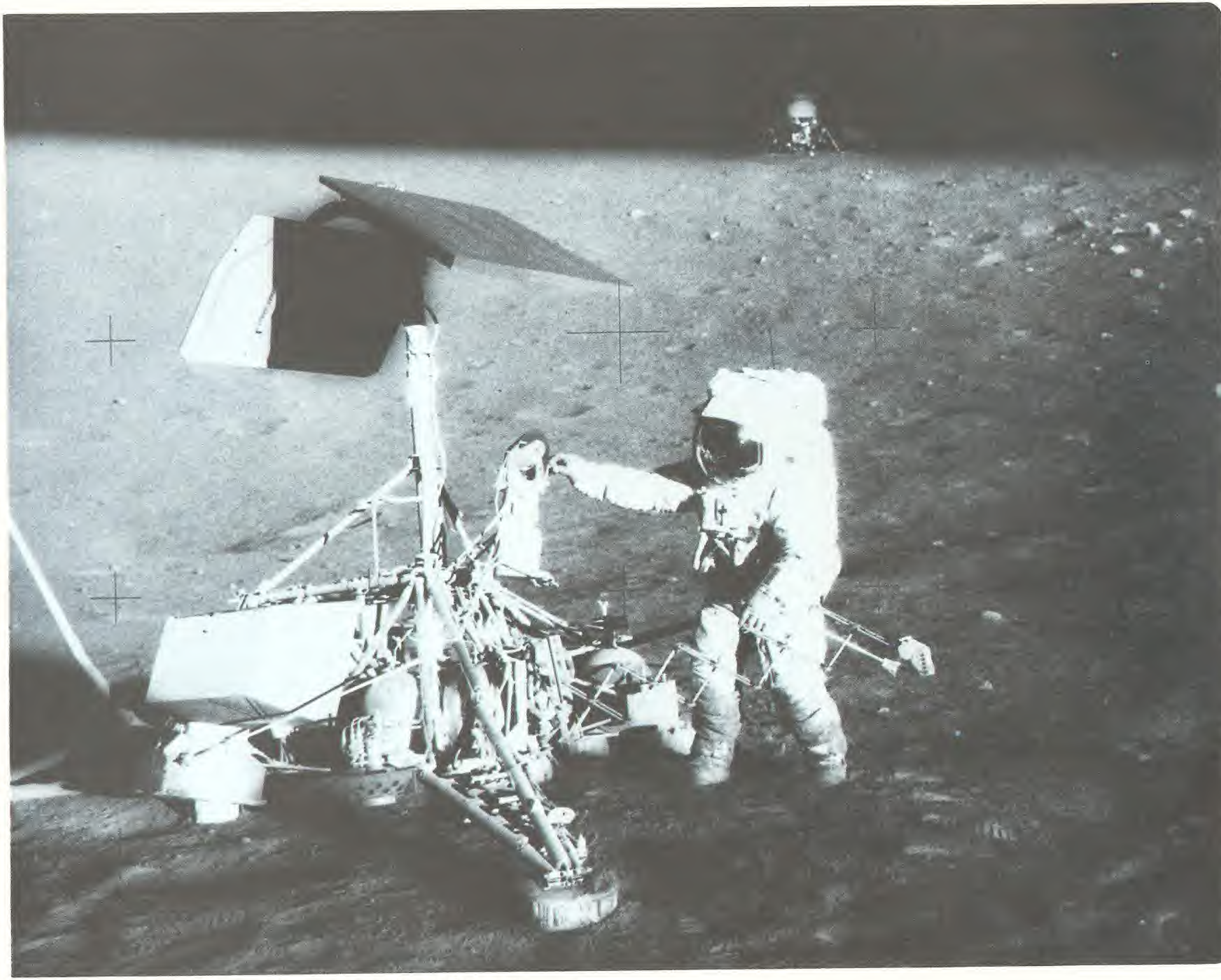
hardware developed and tested during the previous decade.

The first United States satellite, for instance, was orbited by an Army-developed Jupiter-C missile. Delta, the workhorse of NASA's unmanned spacecraft program, employs components developed by the Air Force and Navy. Modified Army/Air Force-developed Redstone and Atlas boosters were utilized for the Mercury program, this country's initial manned space flight effort. Centaur, the world's first space launch vehicle to be powered by liquid hydrogen fuel, and the highly successful Ranger and Mariner space probes were boosted into space by modified Air Force Atlas vehicles.

Technological exchange between military and scientific projects continues to benefit the national space program. The Gemini launch vehicle is a modified Air Force Titan II booster. The Saturn family of heavy launch vehicles, which was developed by NASA expressly for the peaceful exploration of space, evolved from technology acquired during the Army's early Redstone, Jupiter, and Juno missile development programs.

Launch Vehicle Comparison





Apollo 12 Astronaut Conrad inspects Surveyor on surface of the moon

manned space flight

For thousands of years man has dreamed of the day when he would explore the vast universe that surrounds his tiny planet. This aspiration has stemmed not only from his curiosity but also from his fundamental thirst for knowledge and his readiness to accept a challenge.

When Orville Wright made the first powered flight in 1903 at a speed of 31 mph, the significance of his achievement was barely recognized. Yet in little more than half a century following that historic event at Kitty Hawk, man has succeeded in orbiting the Earth at speeds measured in thousands of miles per hour. Now, he is literally reaching for the Moon as the first stop on the way to exploration of the solar system and the infinite reaches of interstellar space beyond.

The achievements in space since the first satellites were launched have paled to insignificance when compared with future projects. Only in the light of what he has already accomplished can man look ahead with the almost certain knowledge that he eventually will realize his age-old dream of exploring the universe.

Viewed in terms of time and distance, the challenge of space exploration seems insurmountable. Yet, a review of the technological accomplishments of the 20th century indicates that what appears as "impossible" is merely "difficult."

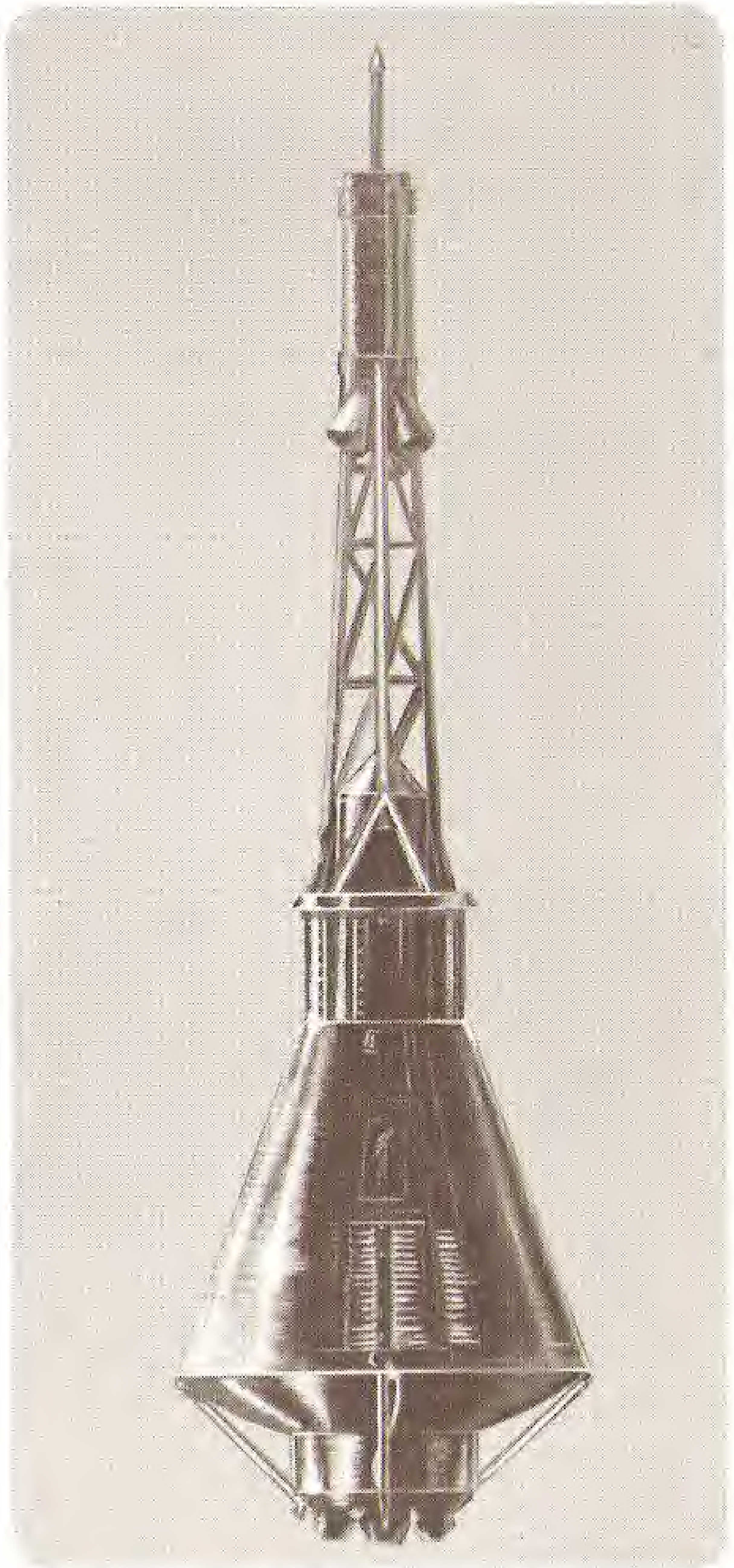
The exploration of space is following the pattern by which flight within the atmosphere was mastered—each new development providing a platform from which to take the next step and each step an increment of scientific knowledge and technological skill.

In all probability man will establish permanent stations in space – laboratories, experimental testing platforms, and way stations as he develops the transportation and life support systems which would make these possible. He will visit the Moon. Someday he also may visit Venus and Mars. He will send probes to the more distant planets and perhaps even the stars. He may discover that life exists elsewhere in the universe. He may communicate with other beings. Regardless of what form his exploration takes, or what other results he may achieve, the greatest benefit will be the knowledge man brings back for the betterment of all mankind.

The benefits that will inevitably result from manned space exploration are just beginning to emerge. But if the history of scientific exploration in the past can serve as a valid guideline to the future, the knowledge to be gained from manned ventures into space will far exceed the most optimistic hopes and dreams.

Although the landing of American astronauts on the Moon in this decade has been set as a major national goal, the three projects directed toward achieving this aim—Mercury, Gemini and Apollo—are designed to lay the foundation for additional progress.

Project Mercury, the initial step in the United States' manned space flight program, has been successfully completed. The knowledge and skills acquired during the Mercury flights are now being applied to the Gemini and Apollo programs—programs which will provide the technology for the challenging enterprises of the future.



mercury

Project Mercury, the first of the manned space flight programs, was organized October 5, 1958, and successfully executed in less than five years.

The primary objectives of Project Mercury were:

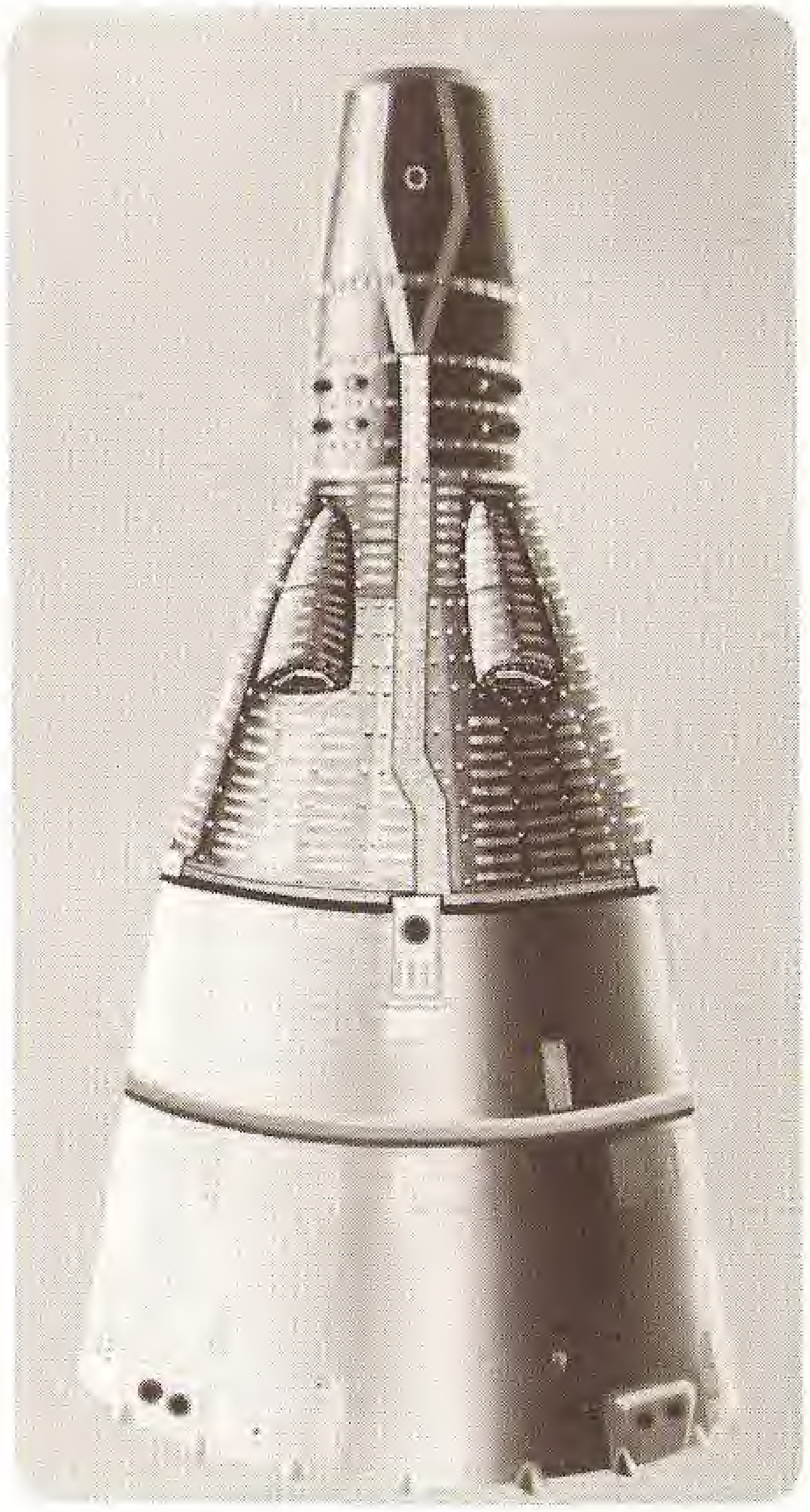
- To place a manned spacecraft in orbital flight around the Earth.
- To investigate man's performance capabilities and his ability to function in the environment of space.
- To recover safely both man and spacecraft.

Project Mercury demonstrated that the high-gravity forces of launch and reentry and weightlessness in orbit for as much as 34 hours did not impair man's ability to control a spacecraft. It proved that man not only augments the reliability of spacecraft controls, but he also can conduct scientific observations and experiments.

Moreover, Project Mercury proved that man can respond to and record the unexpected, a faculty beyond the capability of a machine which can be programmed only to deal with what is known or expected. In addition, the Mercury flights confirmed that man can consume food and beverages and perform other normal functions while in a weightless environment. Finally, Mercury laid a sound foundation for the technology of manned space flight. The experience gained through Project Mercury is directly applicable to the longer and more complex missions of Gemini and Apollo.

The Mercury spacecraft, a one-man, bell-shaped vehicle, 9.5 feet high and 6 feet across at its reentry heat shield base, weighed approximately 4,000 pounds at liftoff and 2,400 pounds at recovery.

The launch vehicle for the Mercury suborbital missions was a modified Redstone rocket generating 78,000 pounds of thrust at liftoff. A modified Atlas rocket whose three engines produced 367,000 pounds thrust was employed for Mercury orbital flights. Complexes 56 and 14 at Cape Kennedy were utilized for the Mercury missions.

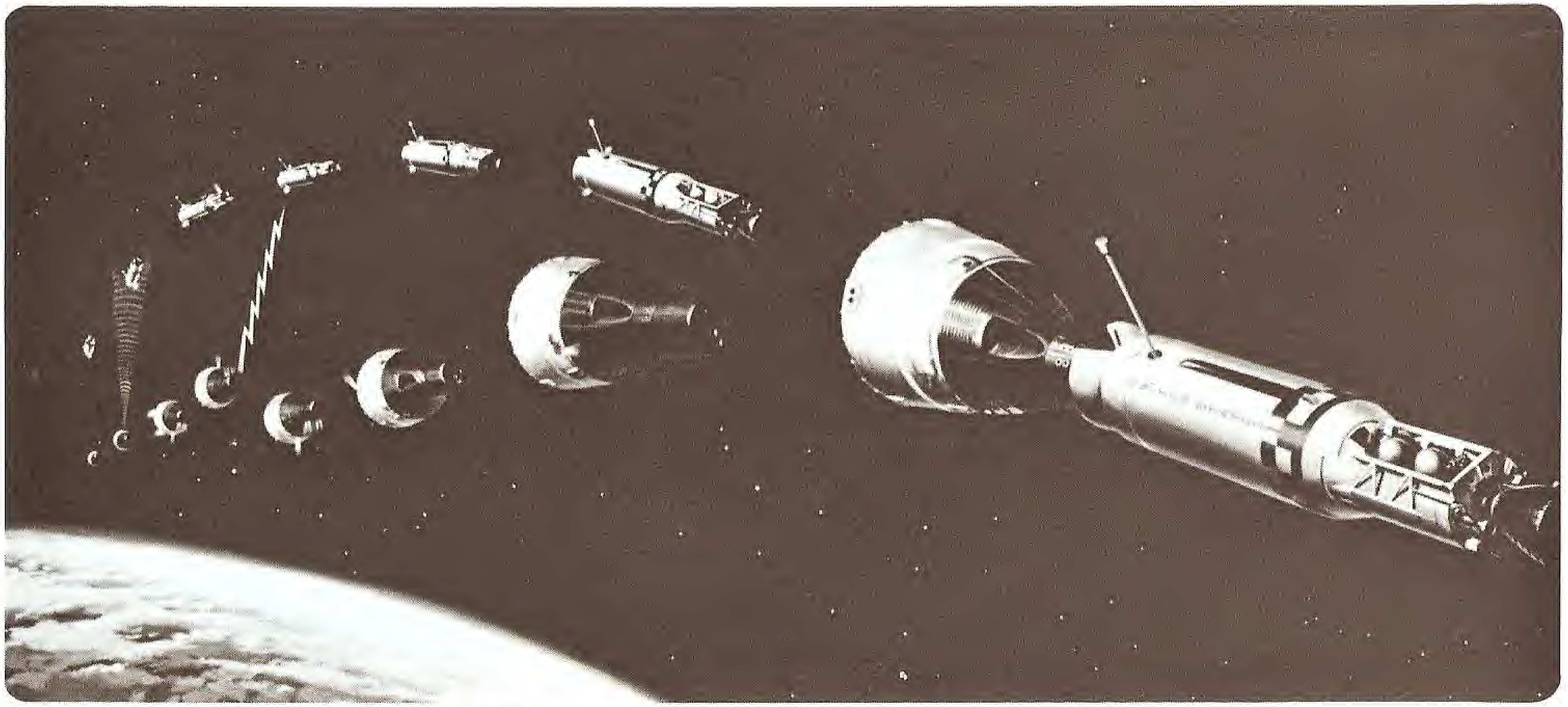


gemini

The current Gemini program is the intermediate step in the three-phase manned space flight effort. Gemini bridges the flight experience gap between the short-duration Mercury missions and the long-duration missions of Apollo.

The major objectives of the Gemini program are:

- To determine man's performance and behavior during prolonged orbital flights of as much as two weeks, including his ability, as a



Gemini-Agena rendezvous and docking in orbit

pilot and controller of his spacecraft.

- To develop and perfect techniques of rendezvous and docking, the bringing together and coupling of two craft in Earth orbit and to accomplish orbital flight maneuvering of manned spacecraft, both before and after docking with a target vehicle.
- To carry out scientific investigations in space that require participation and supervision of men aboard a spacecraft.
- To demonstrate the ability of man to perform useful tasks outside the protective environment of his spacecraft.
- To perfect controlled entry into the atmosphere and landing at a selected site.

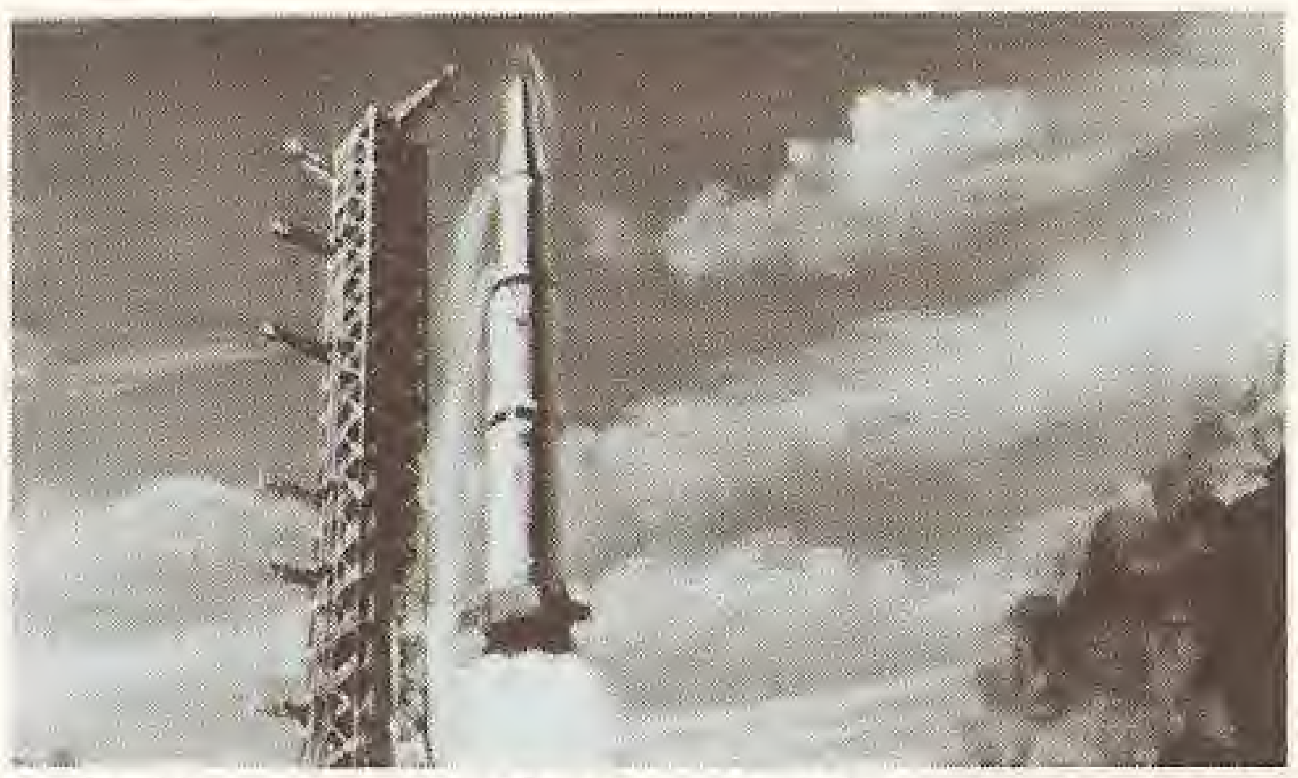
The two-man Gemini spacecraft is a bell-shaped vehicle; however, it is almost twice as heavy, is 20 per cent larger, and contains 50 per cent more volume than the Mercury spacecraft. It is composed of the rendezvous and recovery section, the reentry control section, the cabin section, and the adapter retrograde and equipment sections.

The Gemini launch vehicle is a modified Air Force Titan II rocket which develops a thrust of 430,000 pounds at launch. The two-stage vehicle employs storable, self-igniting propellants, permitting a much shorter countdown period than was necessary for the Mercury flights. The overall length of the Gemini-Titan II space vehicle is 109 feet. Gemini space vehicles are launched from Complex 19 at Cape Kennedy.

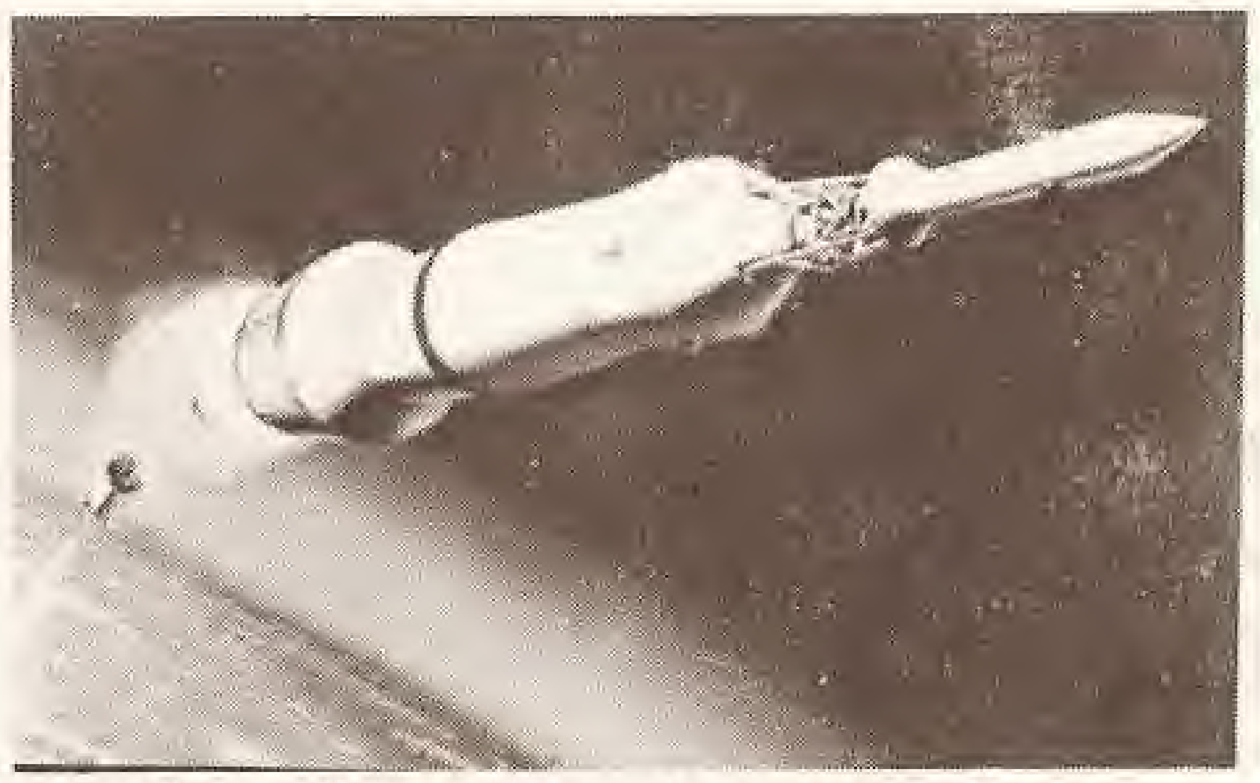
The Gemini program provided the first American demonstration of orbital rendezvous – a skill which must be developed to land American explorers on the Moon in this decade and to conduct the advanced ventures of the future.

The target vehicle for the Gemini rendezvous and docking missions is a modified Agena-D vehicle with a forward-mounted target docking adapter. The docking adapter provides the connecting point for mating the Gemini spacecraft with the target vehicle.

The Agena-D has a multiple restart capability and a rated thrust of approximately 16,000 pounds. It is propelled into orbit by an Atlas Standard Launch Vehicle which generates about 390,000 pounds of thrust. Gemini Atlas/Agena target vehicles have an overall length of 104 feet. They are launched from Complex 14 at Cape Kennedy.

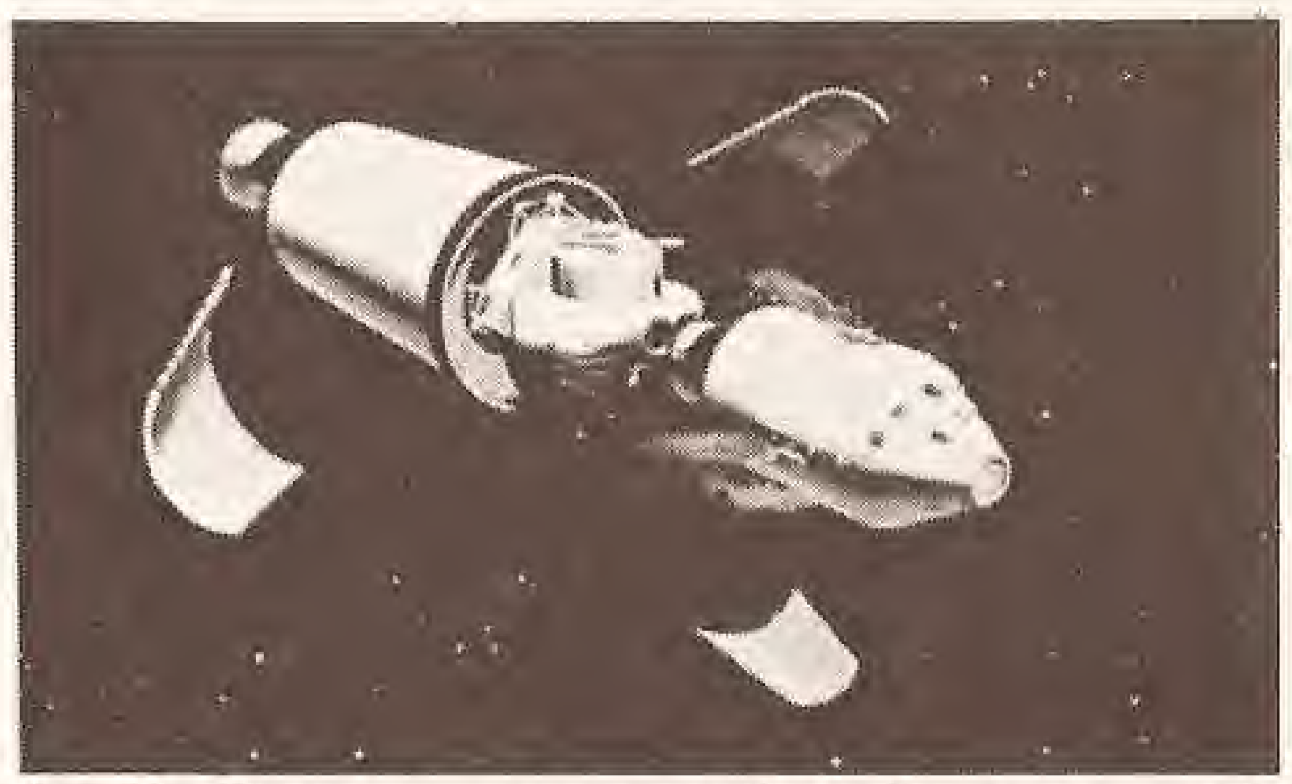


Liftoff – Apollo/Saturn V lifts off from the Spaceport to start lunar missions.

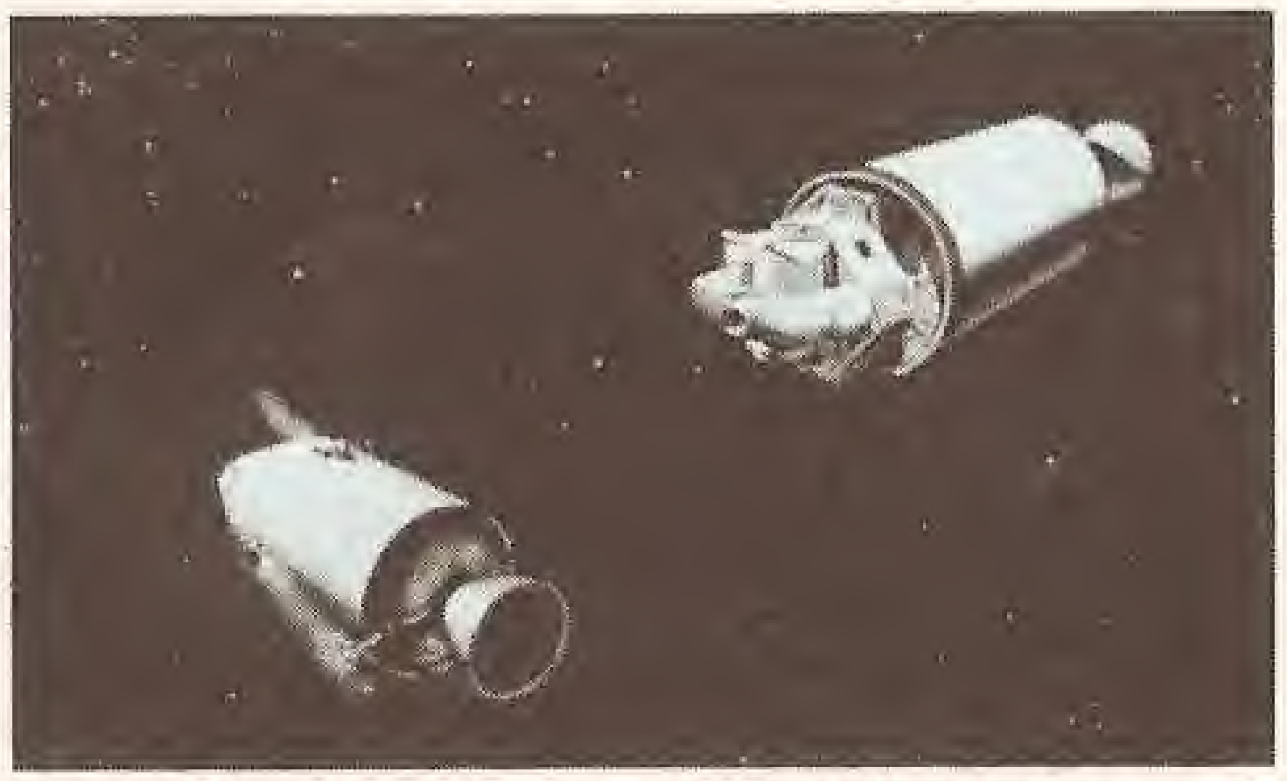


First Stage Separation—first stage drops away; second stage ignites.

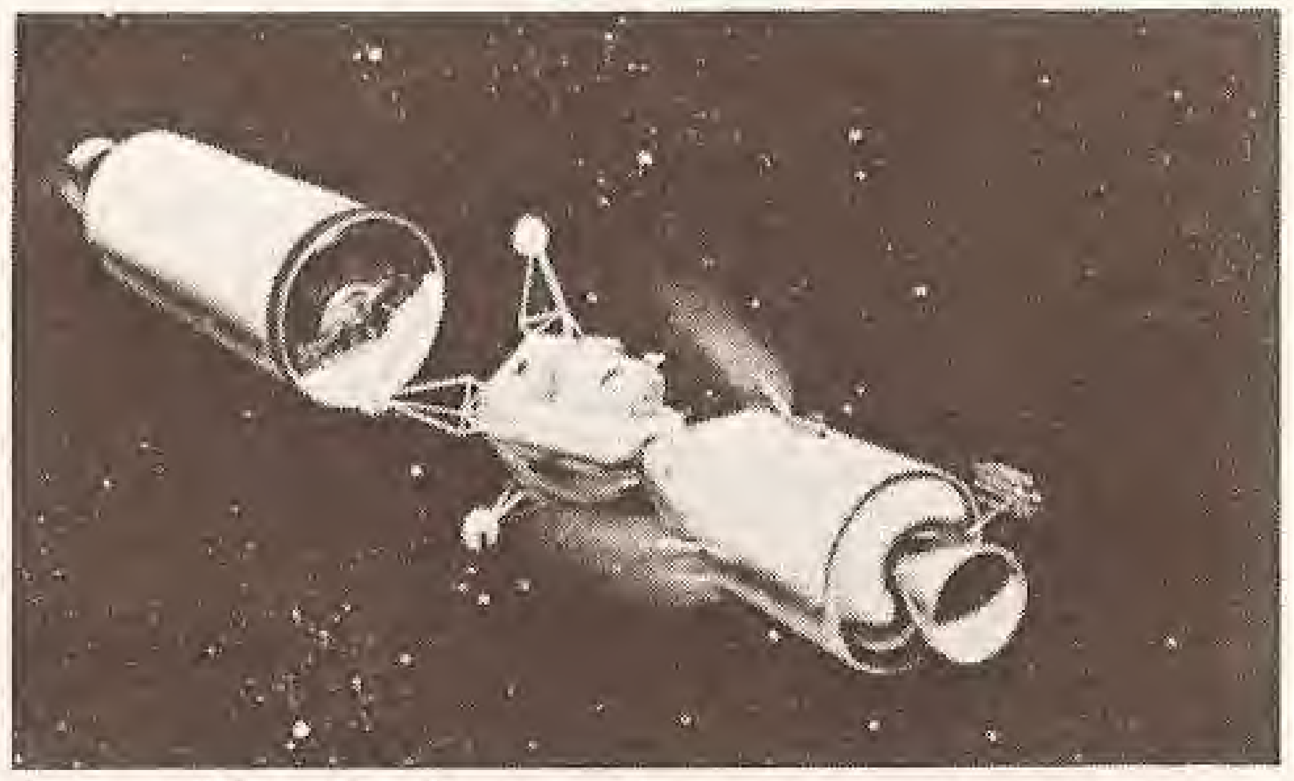
Third Stage Ignition—second stage is jettisoned; third stage hurls spacecraft into orbit.



Apollo Staging – command and service modules separate from Saturn and LM.

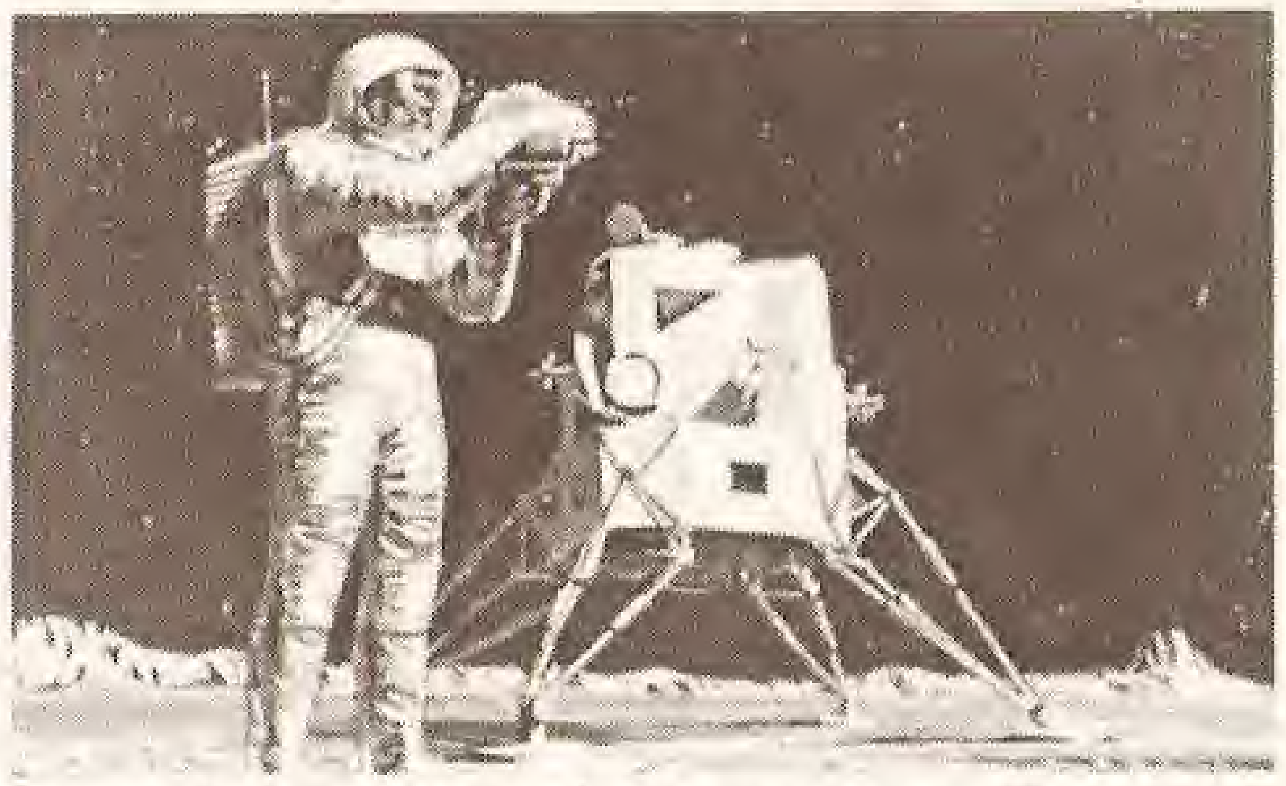


Free Fly-around—command and service modules turn around to dock with LM.



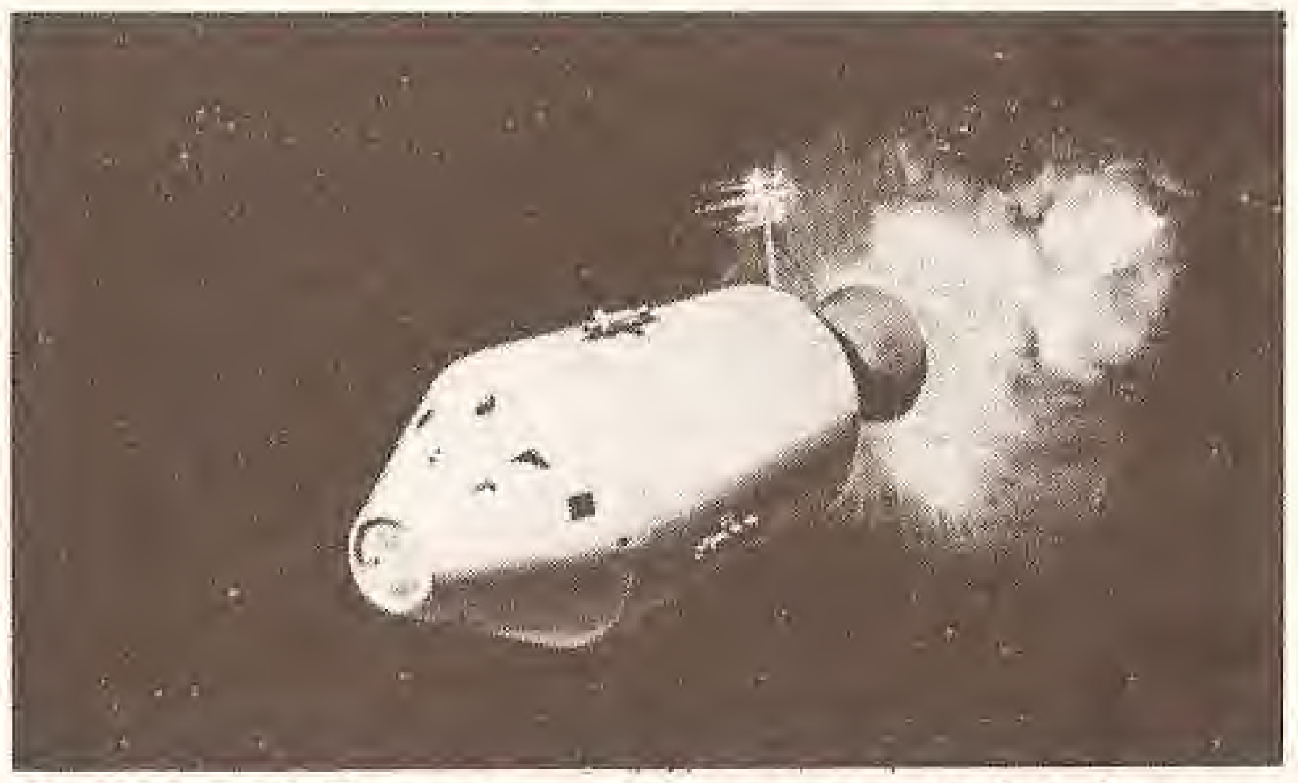
Saturn/Apollo Separation—two astronauts enter LM; third stage is jettisoned.

Descent—command/service modules remain in lunar orbit; LM is guided to Moon's surface.

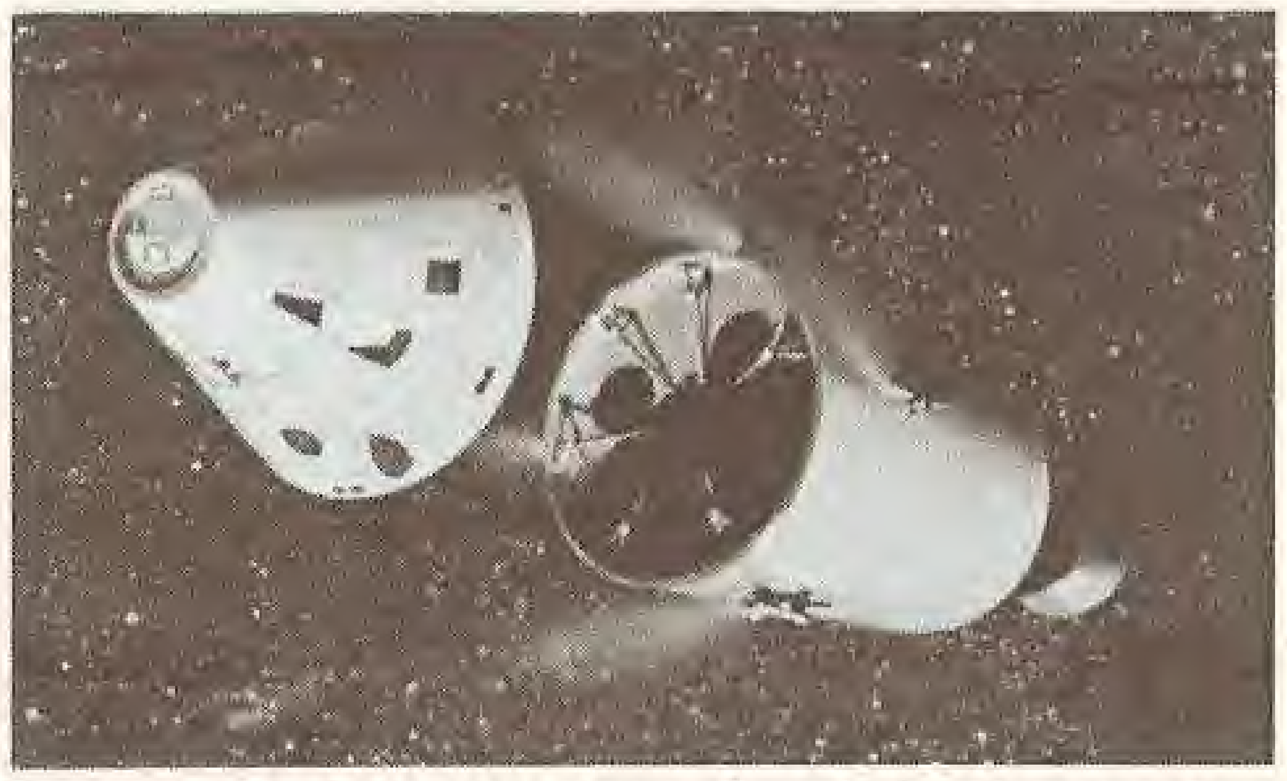


Lunar Exploration—during stay on Moon, astronauts make scientific observations.

Lunar Liftoff – the LM employs expended descent stage as a launch platform.

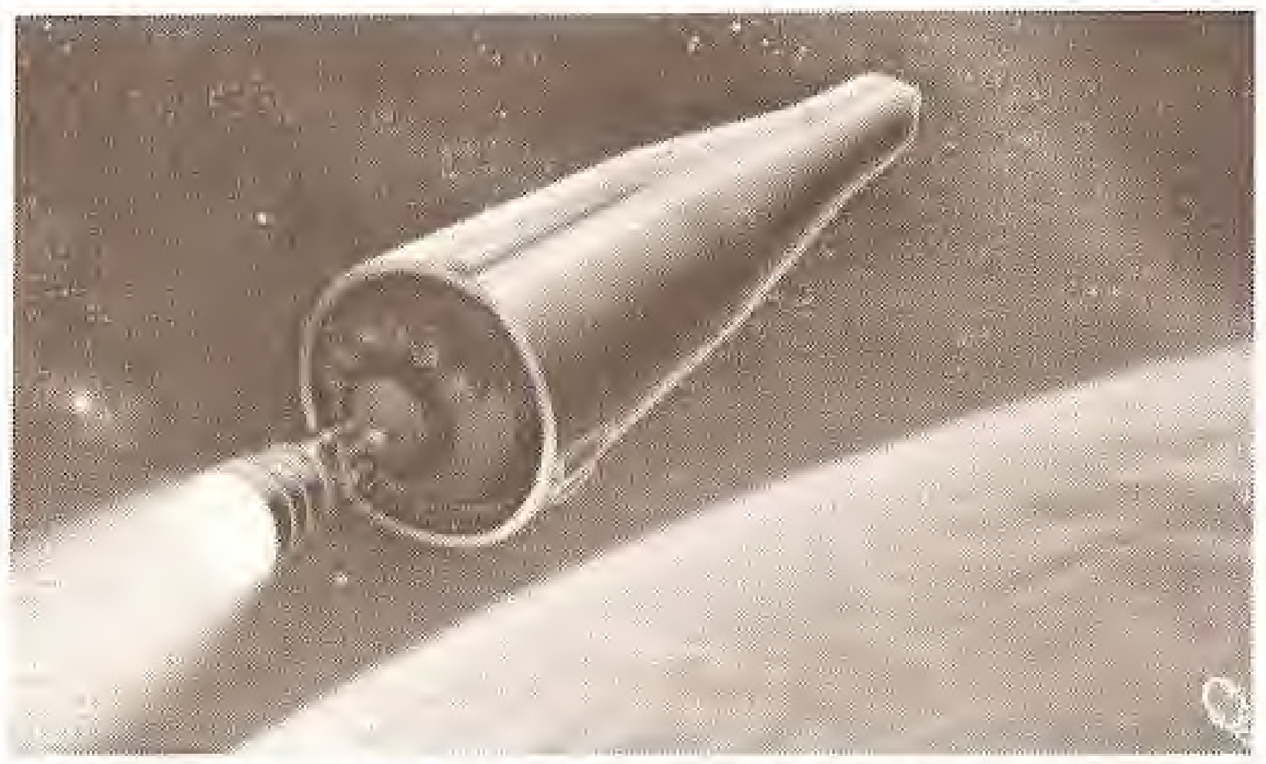


Homeward Bound – LM stays behind; command and service modules head for Earth.



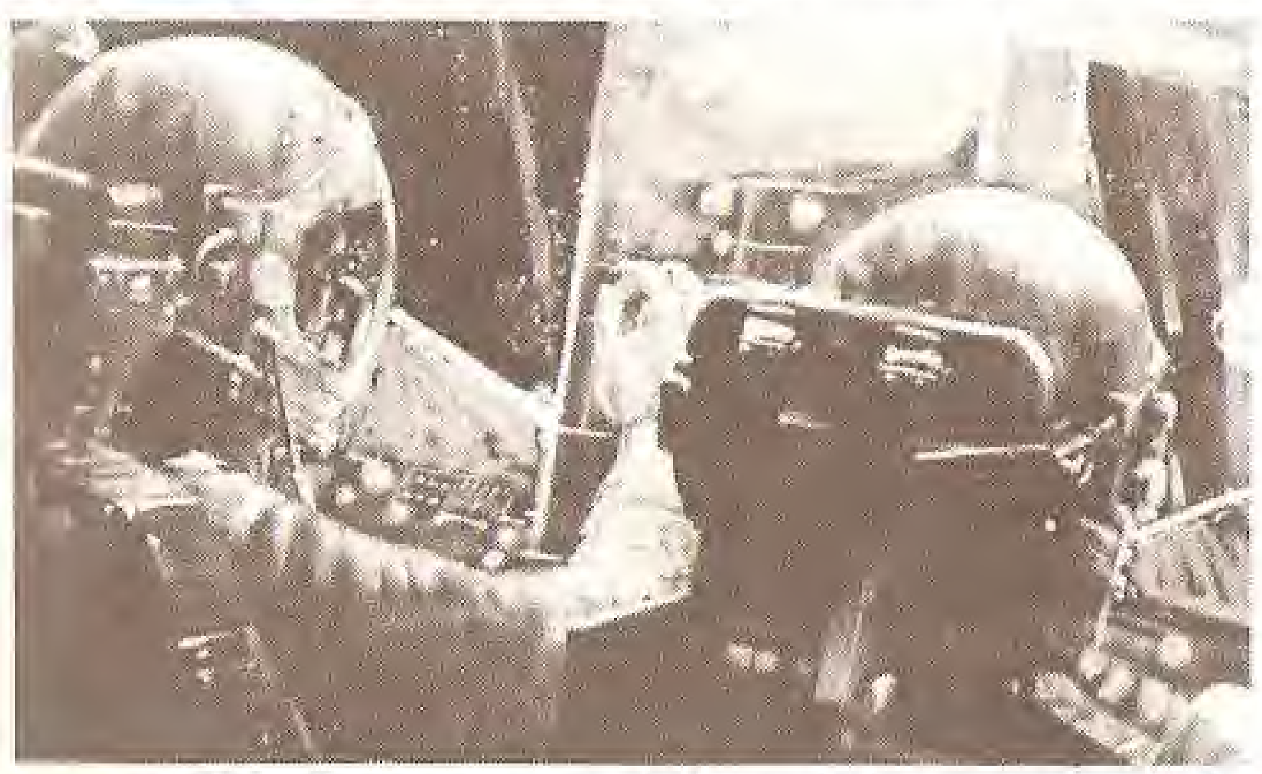
Service Module Jettisoned – prior to reentry, the service module is detached.

Reentry – pilot orients command module so base heat shield takes friction heat.



Translunar Injection — third stage pushes Apollo spacecraft into lunar trajectory.

Lunar Orbit—service module retrofires, slows Apollo spacecraft into 80-mile lunar orbit.



Lunar Rendezvous — LM rejoins command and service modules in lunar orbit.

Landing — command module's chutes deploy to bring craft safely to Earth.

Apollo is the largest and most complex of the manned space flight programs. Its goal, to land American astronauts on the Moon and return them safely to Earth, will be accomplished in three progressive steps:

- Earth-orbital flights of up to two week's duration, during which crews will gain experience in handling the basic spacecraft and will conduct scientific observations requiring man's direct participation. These flights will include orbital rendezvous missions.
- Circumlunar flights in preparation for the lunar landing by American astronauts.
- Lunar landing expedition to explore the Moon and return to Earth.

The astronauts will travel to the Moon in the three-man Apollo spacecraft now under development. Weighing 45 tons, the spacecraft consists of three sections -- a command module, a service module, and a lunar module.

apollo

The command module may be likened to the crew compartment of a commercial jet airliner. It is designed so that three men can eat, sleep, and work in it without wearing pressure suits. In addition to life-support equipment, it contains controls and instruments to enable the astronauts to pilot their craft. Of the three modules, only the command module will return to Earth. Thus, it is constructed to withstand the tremendous deceleration forces and intense heating caused by reentry into the Earth's atmosphere.

The service module contains supplies, fuel, and an engine so the astronauts can maneuver their craft into and out of lunar orbit and alter their course and speed in space.

The lunar module – informally known as the LM – is designed to carry two men from lunar orbit to the Moon's surface for exploration and then back into lunar orbit for rendezvous with the command and service modules. After the crew transfers back to the command module, the LM is jettisoned.

Providing the muscle for the Apollo program is the Saturn family of heavy launch vehicles. The first of these vehicles to be flight tested by the Kennedy Space Center was the Saturn I. Developing 1.5 million pounds of thrust at liftoff, the Saturn I demonstrated the feasibility of clustered rocket boosters and qualified vehicle guidance and control systems. It also tested the structure and design of the Apollo command and service modules, physical compatibility of the launch vehicle and spacecraft, and jettisoning of the Apollo launch escape system. Additionally, Saturn I vehicles orbited large Pegasus micrometeoroid detection satellites to monitor the frequency of micrometeoroids and to determine their threat to manned space flights.

Currently, the uprated Saturn I flight program is underway at Kennedy Space Center. With the greater power of the uprated Saturn I, all three modules of the Apollo spacecraft can be launched into Earth orbit. Initially, the flights are unmanned. Later, uprated Saturn I vehicles will launch three astronauts on Earth orbital missions up to 14 days in duration.

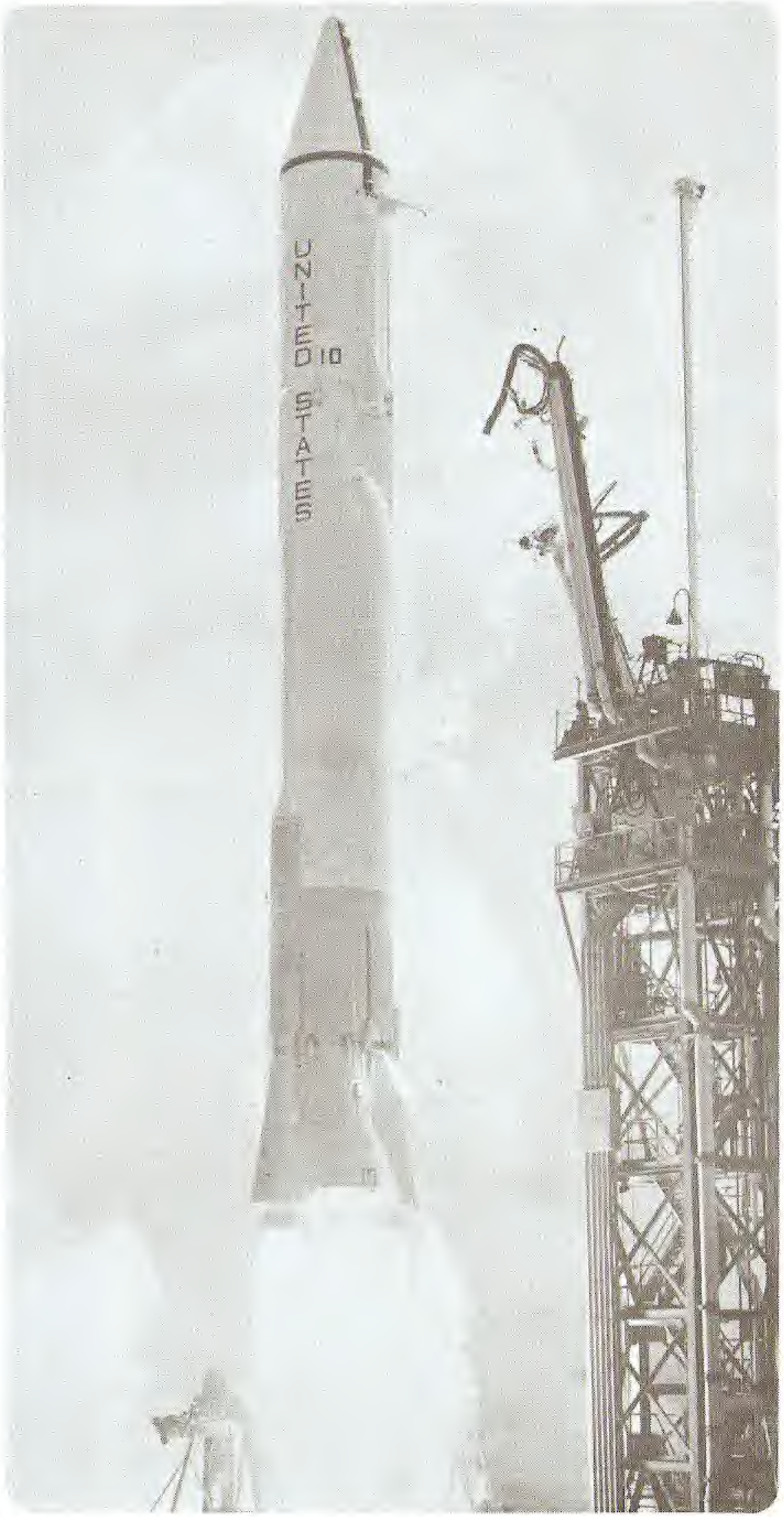
Circumlunar and lunar landing missions will be undertaken when the enormous power of the Saturn V launch vehicle is available. Together with the three modules of the Apollo spacecraft, the Saturn V will stand 364 feet, weigh about 6 million pounds at launch, and develop 7.5 million pounds of thrust at liftoff.

Development of the Saturn vehicles is the responsibility of the Marshall Space Flight Center, Huntsville, Alabama. The Manned Spacecraft Center, Houston, Texas, has responsibility for Apollo spacecraft development, training of the flight crews, and conducting the flight missions. Assembly, checkout, and launch of the Apollo/Saturn space vehicles are conducted at Cape Kennedy and at the nation's Spaceport by the Kennedy Space Center's integrated government-industry launch team.

satellites and space probes

Unmanned spacecraft are making important contributions to man's quest for knowledge about the world in which he lives and the universe around him. Much of this knowledge is directly attributable to the growing family of scientific satellites and space probes launched from Cape Kennedy.

Scientific satellites are probing the Earth's atmosphere and the near reaches of space, providing valuable scientific data to support future manned and unmanned space exploration. Explorer satellites have mapped the Earth's magnetic field and have pioneered in gaining new knowledge of the Earth's shape and mass distribution. Explorer I, this country's first satellite which was launched from Cape Kennedy on January 31, 1958, discovered that the Earth was surrounded by a belt of deadly radiation, subsequently named the Van Allen Radiation Region. Other satellites have furnished information on micrometeoroids, temperatures in space, radiation and magnetic fields, upper atmospheric conditions, solar activity, and other phenomena.



Surveyor spacecraft begins trip to Moon atop Centaur

Meteorological satellites are obtaining basic information about weather phenomena and are laying the groundwork for a rapid weather-forecasting system that ultimately will benefit all mankind. The TIROS weather satellites have achieved the most significant advance in weather forecasting since the invention of the barometer over three centuries ago. These orbiting "weathermen" have been launched by Delta vehicles from Cape Kennedy Complex 17 in a continuing program since April 1960, and have returned well over a million cloud-cover photographs. Eventually, improved meteorological satellites operating in conjunction with a worldwide system of receiving stations will provide data on weather conditions over the entire globe several times a day. Fast, accurate weather reporting coupled with long-range weather prediction can be worth untold millions of dollars to agriculture, business, and industry. Ultimately, such a system may lead to control of the world's weather.

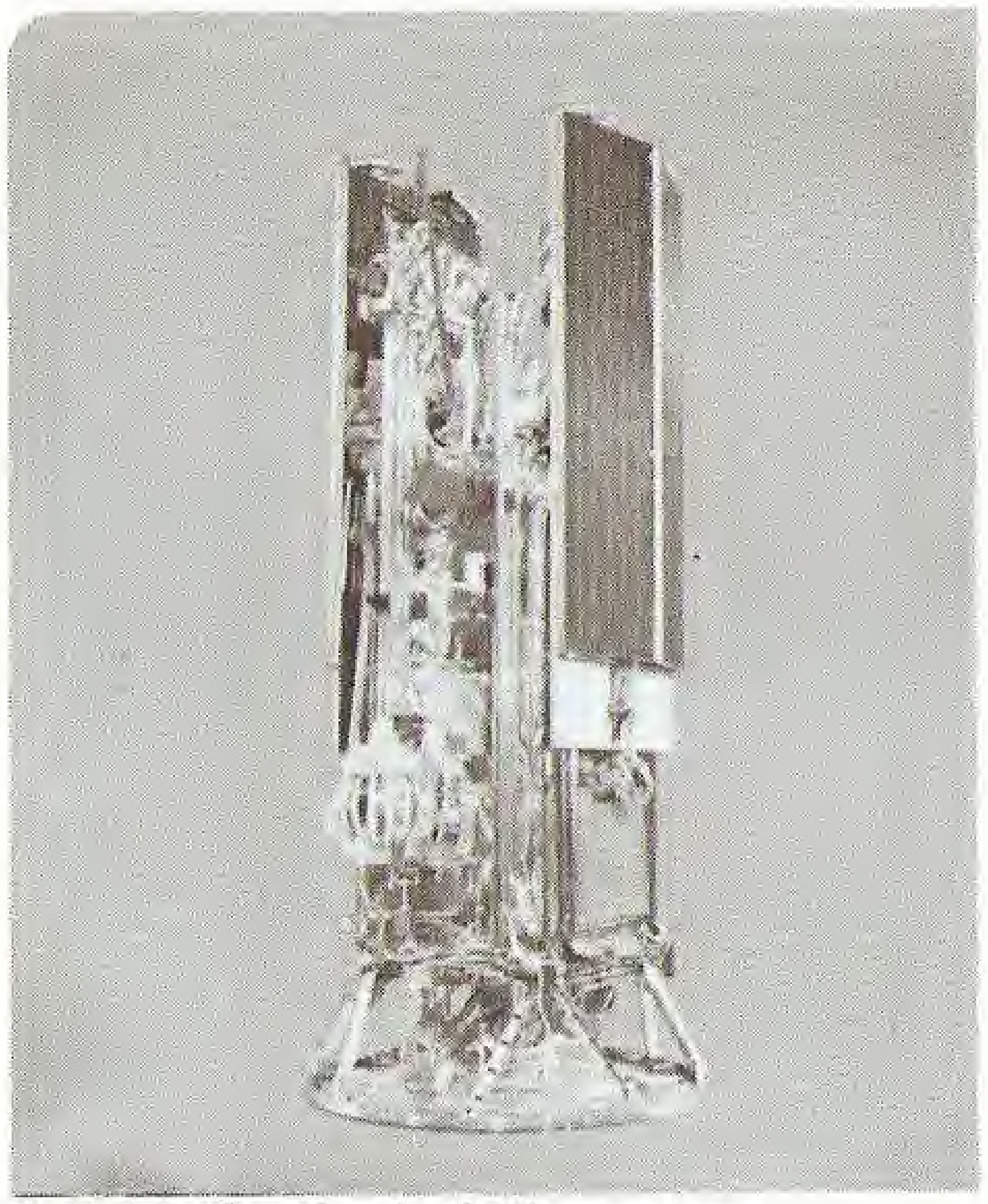
Communications satellites such as Echo, Telstar, Relay, Syncom, and Early Bird are shrinking the distance between continents, and are leading to better understanding among the world's peoples. Launched by Delta vehicles from Cape Kennedy Complex 17, these unseen space sentinels are pioneering a real time global communications system which someday will provide instantaneous communication between all nations of the world.

Exploration of the Moon's surface and environment by unmanned space probes is essential to obtain data for the manned lunar landing program. This information is important also to geologists and astronomers who expect it to yield clues to the origin of the Moon, the solar system, and perhaps even the universe.

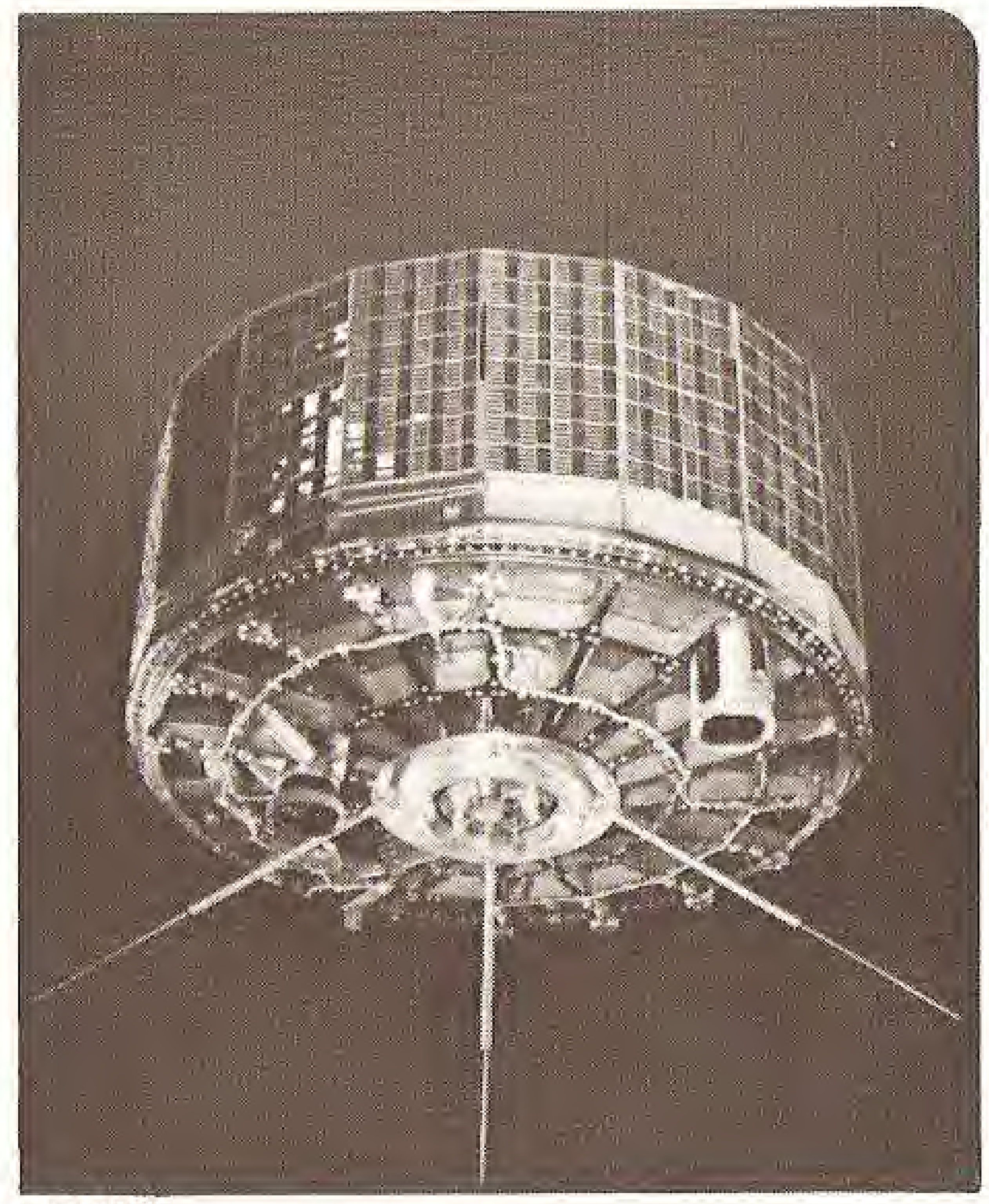
Lunar missions, though extremely difficult, have proved highly successful. Rangers 7, 8, and 9 returned thousands of close-up pictures of the Moon's surface. On June 2, 1966, the Surveyor 1 spacecraft soft-landed on the Moon and transmitted thousands of detailed photographs of the lunar surface, information vital to the American manned lunar landing. Surveyor spacecraft are launched by Atlas/Centaur vehicles from Cape Kennedy Complex 36.

Investigations of other planets of the solar system are conducted by unmanned Mariner spacecraft. On December 14, 1962, Mariner 2 became the first spacecraft to scan another planet at close range as it passed within 21,600 miles of Venus. Mariner 4, following an eight-month journey through space, passed within 6,000 miles of Mars on July 14, 1965. Observations made by Mariner 4's instruments and camera proved invaluable to scientists seeking clues to the possibility of life on the planet. Mariner spacecraft are launched by Atlas/Agena vehicles from Cape Kennedy Complexes 12 and 13.

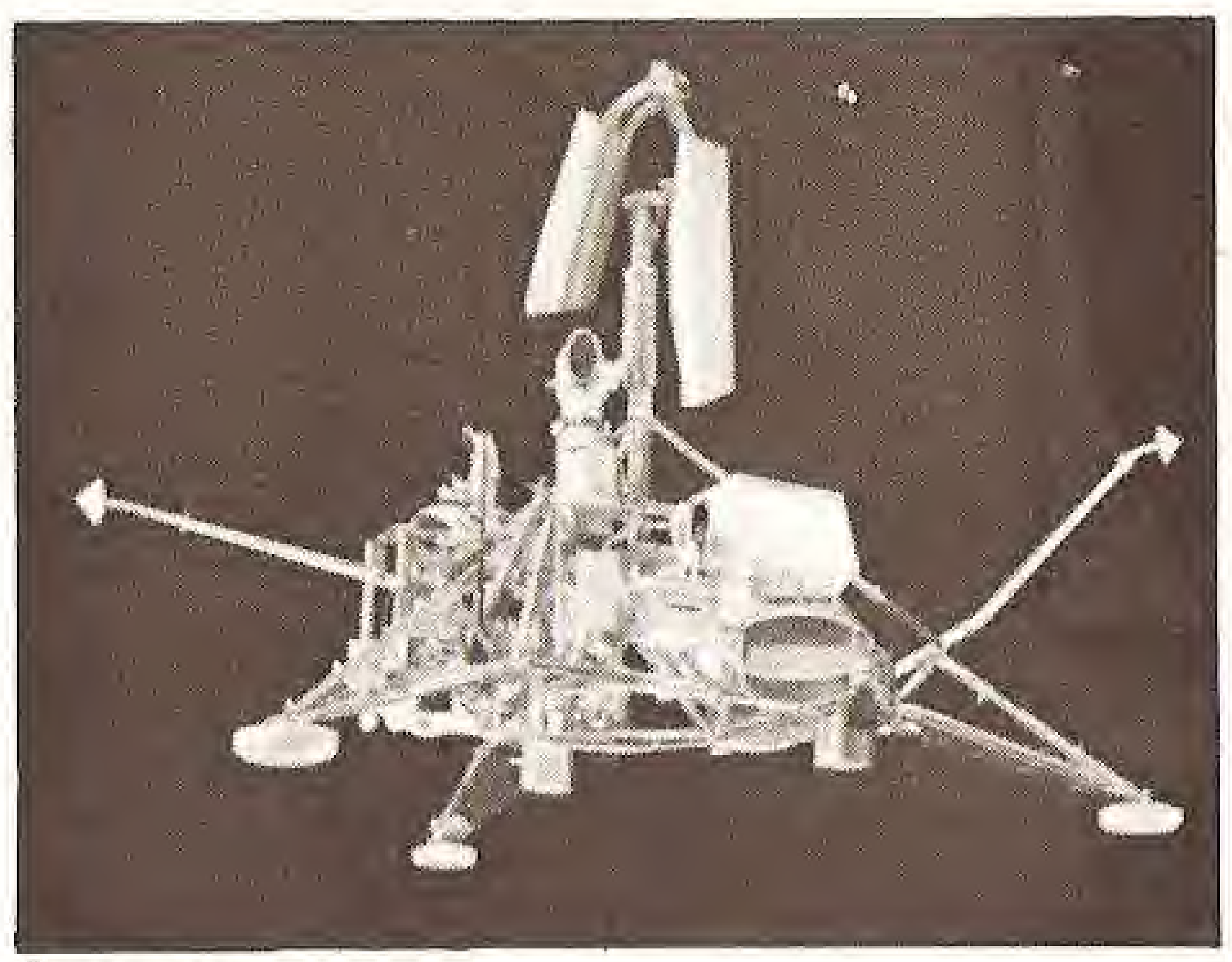
Goddard Space Flight Center manages NASA's unmanned scientific, meteorological, and communications satellite programs. Unmanned lunar, planetary, and interplanetary space programs are managed by Jet Propulsion Laboratory. Launch operations for these programs are conducted by the Kennedy Space Center.



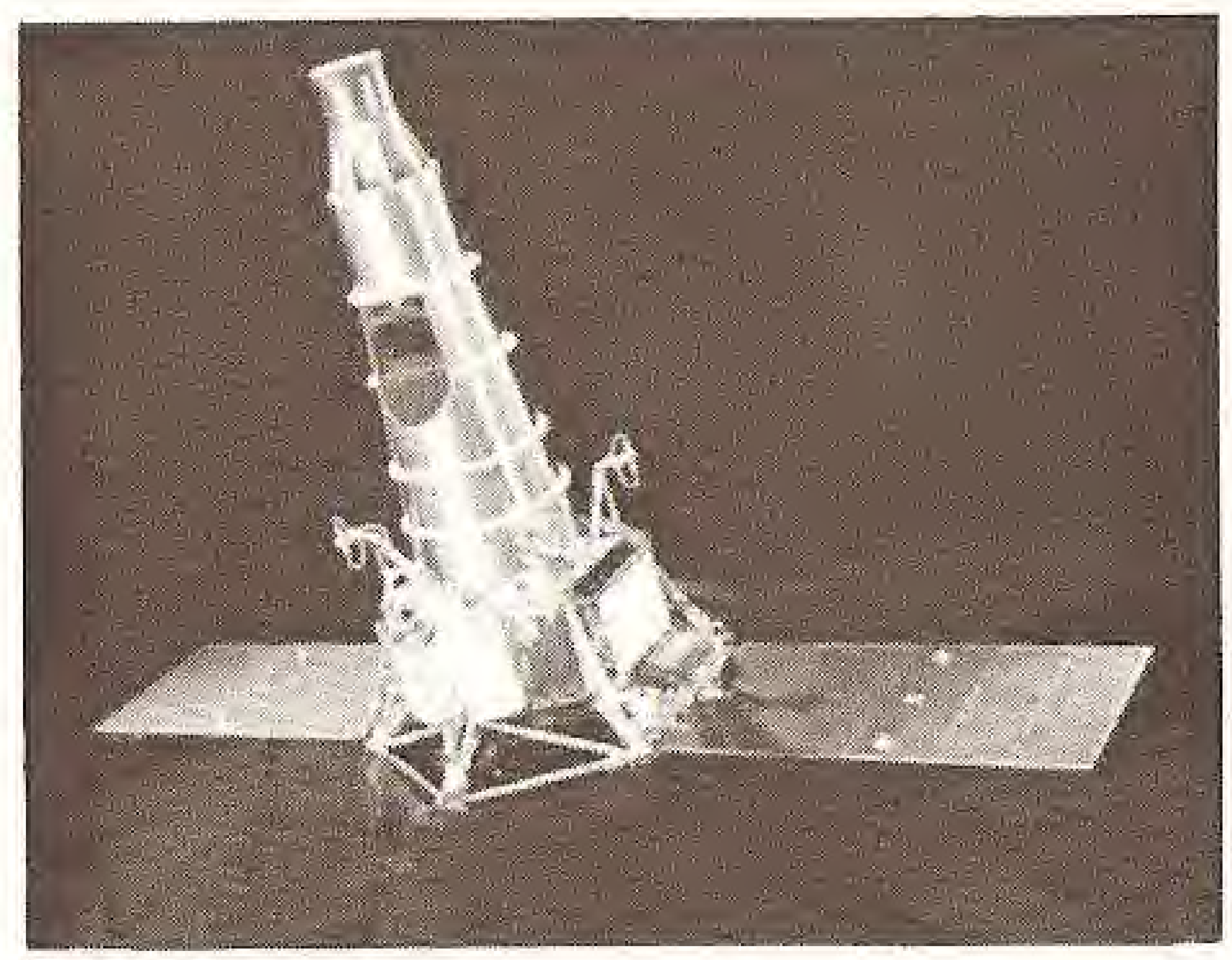
Orbiting Geophysical Observatory



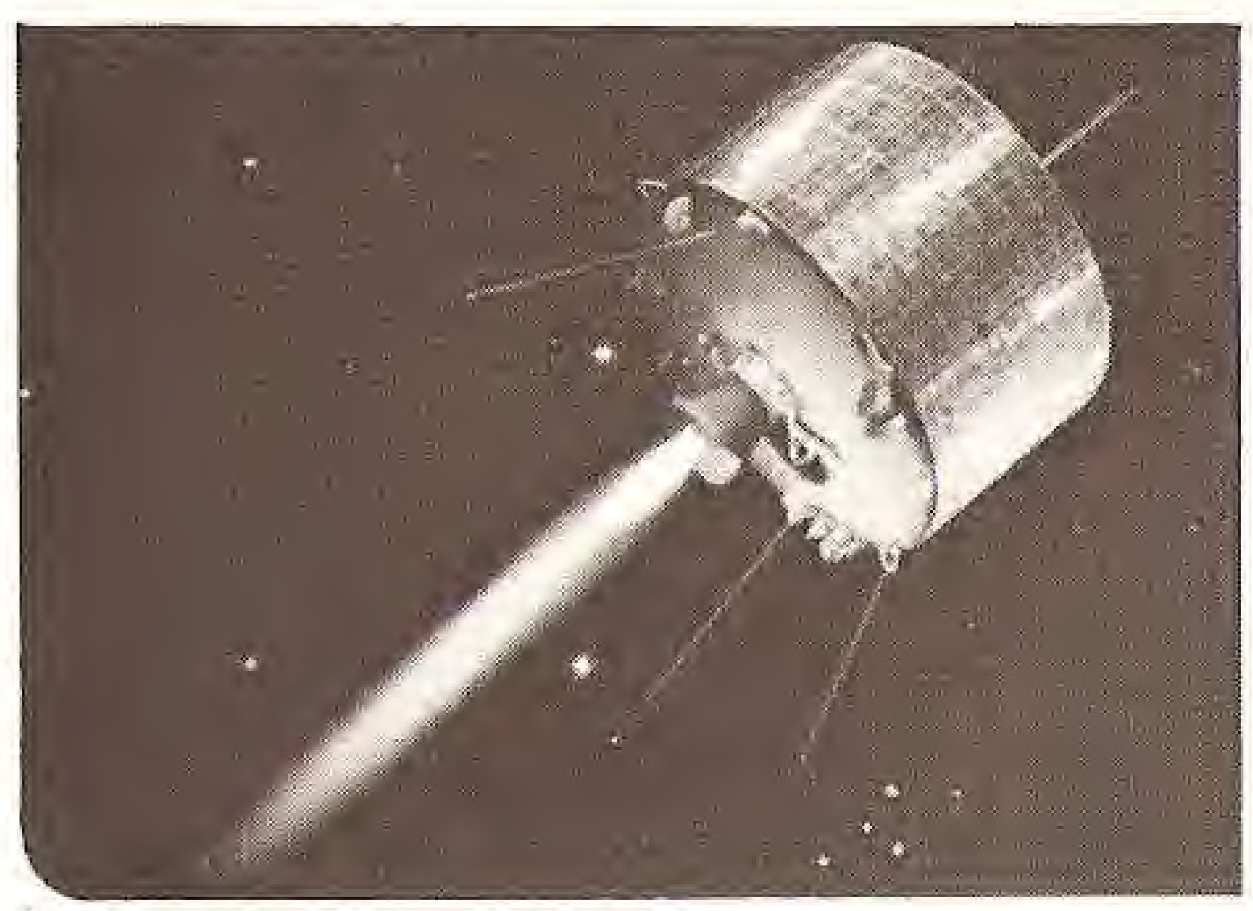
TIROS



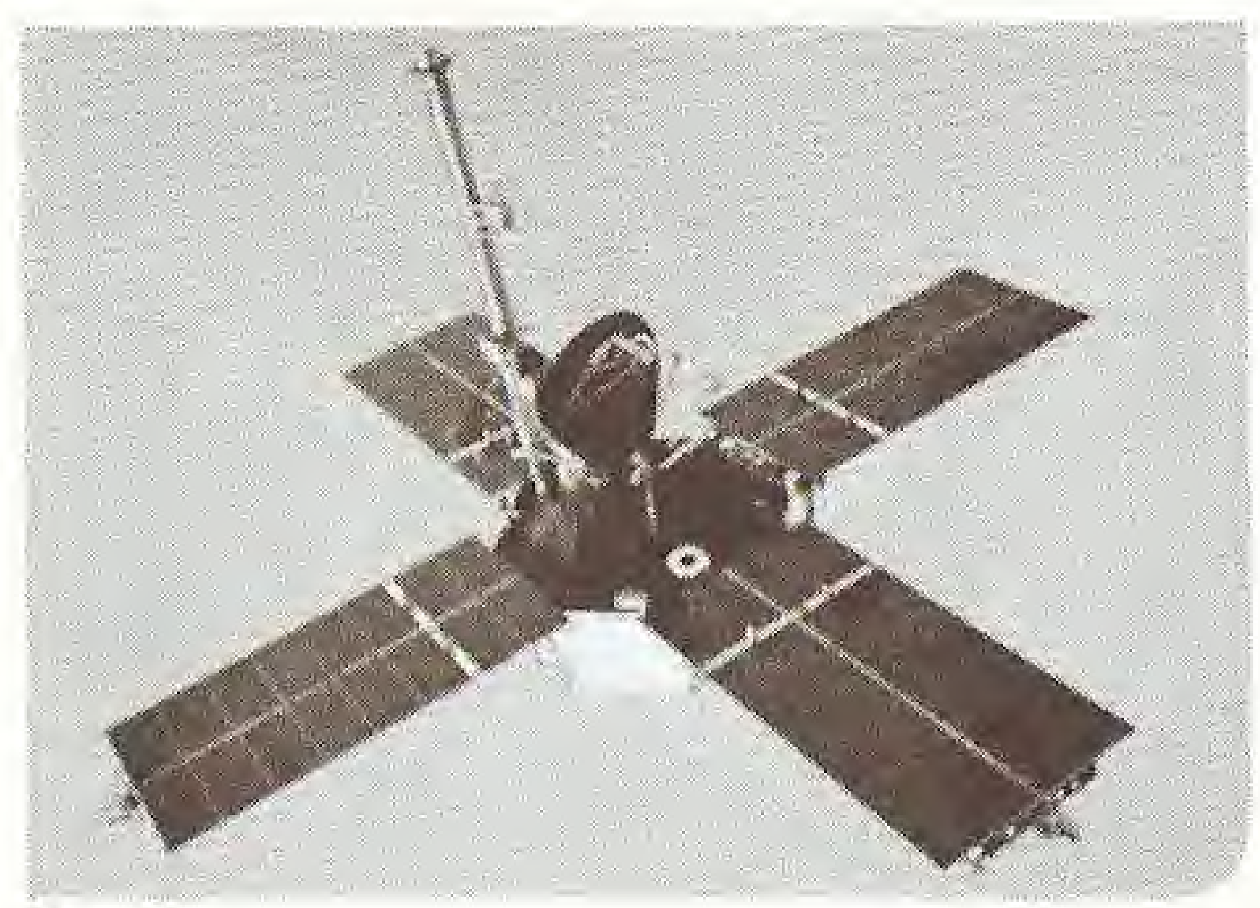
Surveyor



Ranger



Syncom



Mariner

Launch Complex 39

launch complex 39

Launch Complex 39, the nation's first operational spaceport, ranks as one of history's great engineering achievements. Developed and operated by the Kennedy Space Center, the immense facility is designed to accommodate the massive Apollo/Saturn V space vehicle which will carry American astronauts to the Moon. It is from this unique installation that U. S. preeminence in space exploration will be firmly established.

Complex 39 reflects a new approach to launch operations. In contrast to the launch facilities presently utilized at Cape Kennedy, Complex 39 permits a high launch rate, economy of operation, and superior flexibility. This new approach, known as the "mobile concept," provides for assembly and checkout of the Apollo/Saturn V vehicle in the controlled environment of a building, its subsequent transfer to a distant launch site, and launch with a minimum of time.

The major components of Complex 39 include: the Vehicle Assembly Building, where the space vehicle is assembled and tested; the Launch Control Center, which houses display, monitoring, and control equipment for checkout and launch operations; the Mobile Launcher, upon which the space vehicle is erected for checkout, transfer, and launch and which provides internal access to the vehicle and spacecraft during testing; the Crawler-Transporter, which transfers the space vehicle and Mobile Launcher to the launch site; the Crawlerway, a specially prepared roadway over which the Crawler-Transporter travels to deliver the Apollo/Saturn V to the launch site; the Mobile Servicing Structure, which provides external access to the vehicle and spacecraft at the launch site; and the launch site, from which the space vehicle is launched on Earth orbital and lunar missions.

The Vehicle Assembly Building provides a startling contrast to the low Merritt Island landscape. Covering 8 acres of ground, the Vehicle Assembly Building consists of two major working areas: a 525-foot-high high bay area and a 210-foot-high low bay area.

The high bay contains four vehicle assembly and checkout bays, each capable of accommodating a fully assembled, heavy-class space vehicle. The low bay contains eight preparation and checkout cells for the upper stages of the Saturn V vehicle.

Vehicle stages are shipped by barge from fabrication centers to a turning basin near the Vehicle Assembly Building, off-loaded onto special carriers, and transported to the building. The first stage is towed to the high bay area and erected on the Mobile Launcher. Four holddown-support arms on the Mobile Launcher platform secure the booster in place. Work platforms are positioned around the booster for inspection and testing. Concurrently, upper stages of the Saturn V are delivered to the low bay cells, inspected, and tested.

When testing of the individual stages is completed, the upper stages are prepared for mating and moved to the high bay area. All components of the space vehicle, including the Apollo spacecraft, are assembled vertically in the high bay

Launch Control Center

Vehicle Assembly Building

area. The fully assembled space vehicle then undergoes final integrated checkout and simulated flight tests.

The Launch Control Center serves as the "blockhouse" for Launch Complex 39. Located adjacent to the Vehicle Assembly Building and connected to the high bay area by an enclosed bridge, the four-story concrete structure controls all phases of the launch operation.

The first floor of the Launch Control Center contains offices, dispensary, and a cafeteria. The second floor is allocated to telemetry, measuring, and checkout systems for use during stage and vehicle assembly in the Vehicle Assembly Building, and for launch operations at the launch site.

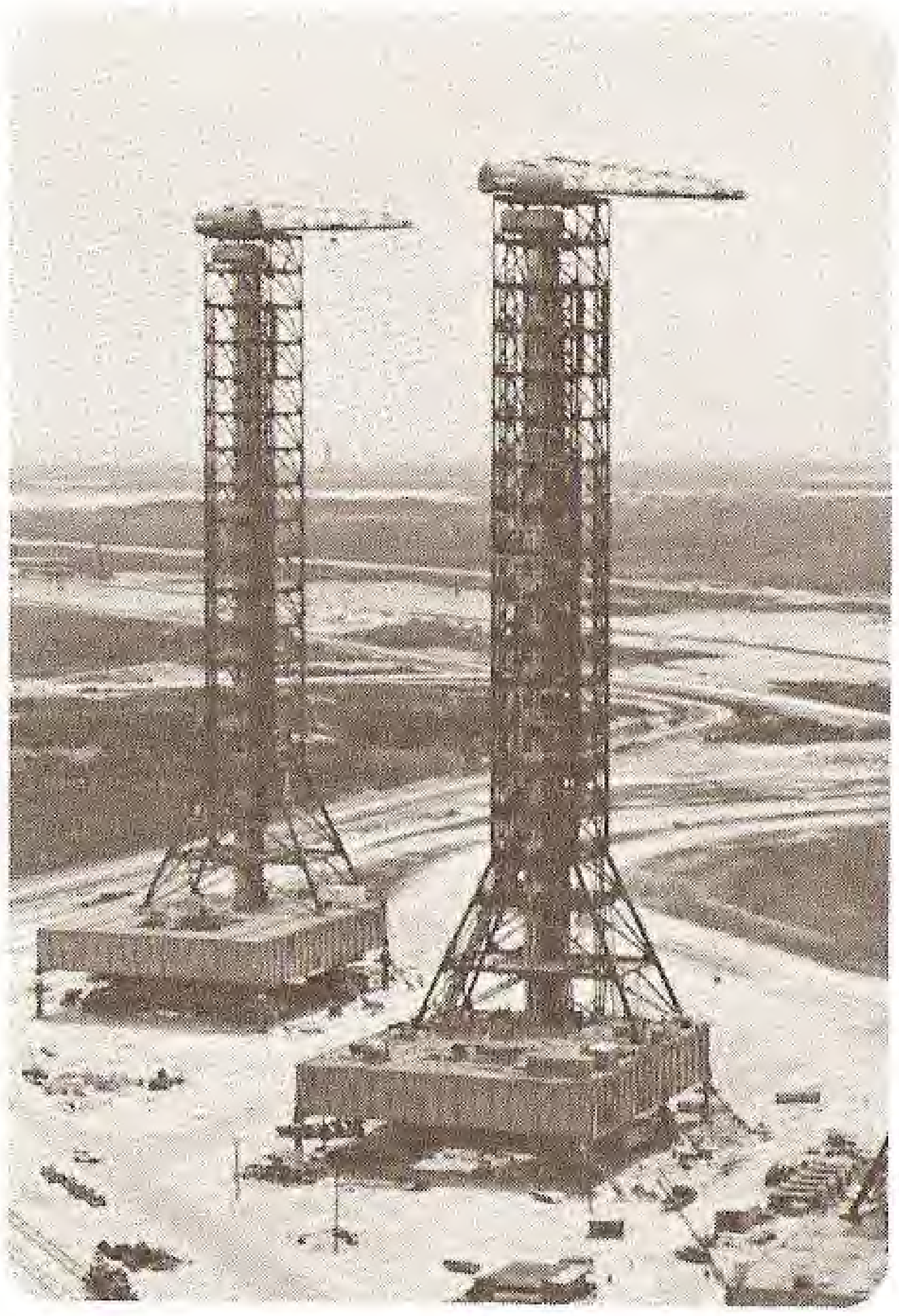
Four firing rooms occupy the third floor – one for each high bay in the Vehicle Assembly Building. These rooms will contain control, monitoring, and display equipment required for automatic vehicle checkout and launch. Each firing room is supported by a computer room, which is a key element in the automatic checkout and launch sequence.

Direct viewing of the firing rooms and the launch area is possible from the building's mezzanine level through specially designed, laminated and tinted glass windows. Electrically controlled sun louvers are positioned outside the windows.

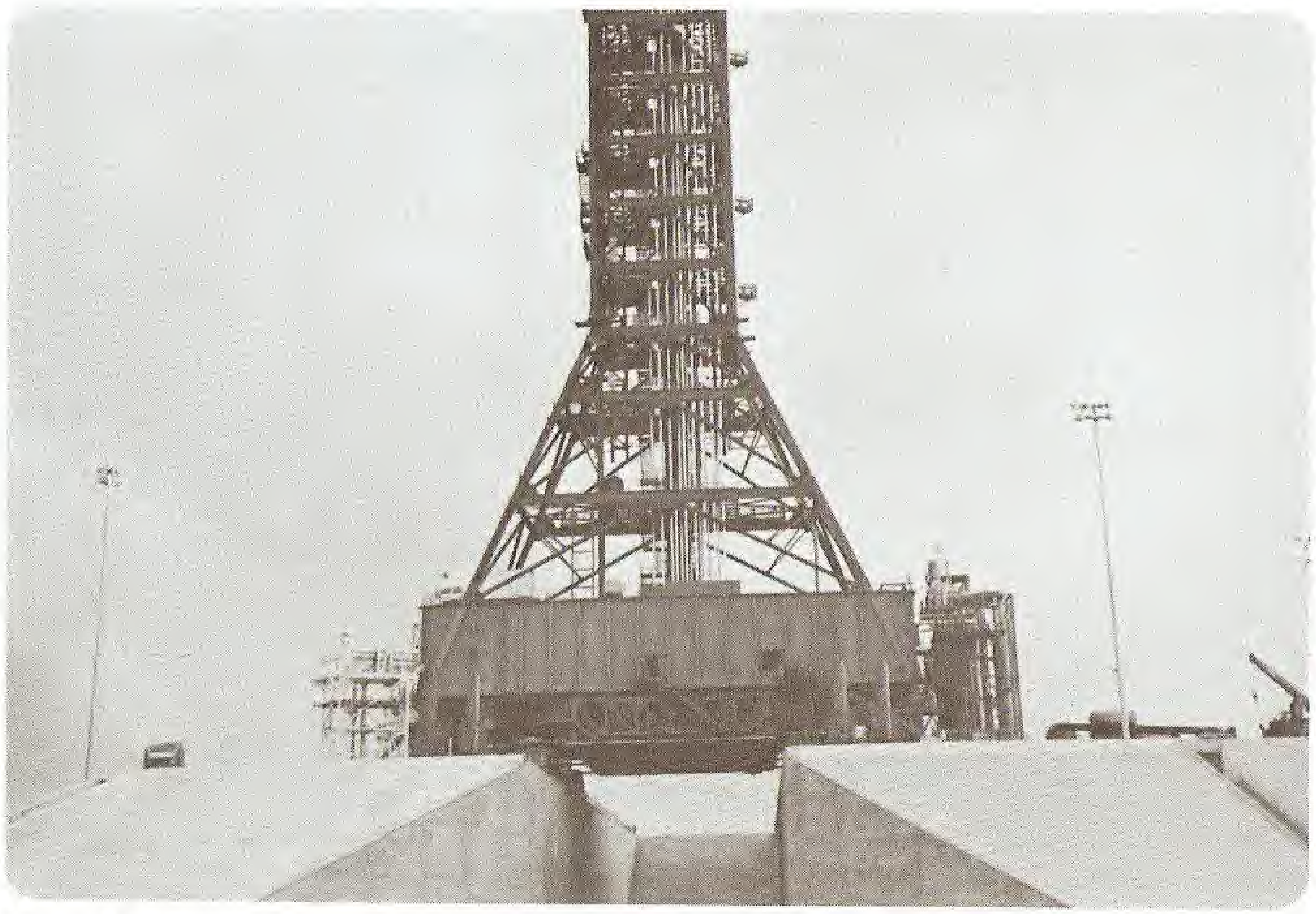
The Mobile Launcher, the key to launch operations at Complex 39, actually performs a dual function. It serves as an assembly platform within the Vehicle Assembly Building and as a launch platform and umbilical tower at the launch site located several miles away.

The Mobile Launcher is a 446-foot-high structure with a base platform measuring 25 feet high, 160 feet long, and 135 feet wide. It weighs 10.6 million pounds. Whether in the Vehicle Assembly Building, at the launch site, or in its parking area, the Mobile Launcher is positioned on six 22-foot-high steel pedestals.

Nine swing arms extend from the Mobile Launcher's tower. The three astronauts will enter the Apollo spacecraft via the top swing arm. These arms are designed to swing rapidly away from the vehicle during launch. Besides carrying vital umbilical lines – propellant, pneumatic, electrical, data link – to the space vehicle, the swing arms also permit a catwalk access to the vehicle during the final phase of countdown.



Mobile Launchers



Launch Site

The Apollo/Saturn V is positioned on the Mobile Launcher and secured by four support and holddown arms. At the pad these arms hold the vehicle during thrust buildup of the engines. A 45-square-foot opening in the base platform permits passage of engine exhausts at ignition. Three Mobile Launchers have been constructed at Complex 39.

A tracked vehicle known as the Crawler-Transporter moves the 36-story Apollo/Saturn V space vehicle and Mobile Launcher from the Vehicle Assembly Building to the launch site. Two of the crawler vehicles are stationed at Complex 39.

The Crawler-Transporter is similar to machines used in strip mining operations. Weighing approximately 6 million pounds, it is 131 feet long and 114 feet wide. Its height is adjustable from 20 to 26 feet. The vehicle moves on four double-tracked crawlers, each 10 feet high and 40 feet long. Each shoe of the crawler track weighs about a ton. There are 57 shoes on each track and a total of 8 tracks on the entire vehicle.

Two main drive diesel engines provide 5,500 horsepower. Two other diesels generate 2,130 horsepower for leveling, jacking, steering, lighting, ventilating, and electronic systems. Auxiliary generators provide power to the Mobile Launcher when carried by the Crawler-Transporter.

In operation, the Crawler slips under the Mobile Launcher while inside the Vehicle Assembly Building. Its 16 hydraulic jacks raise the Mobile Launcher, with the space vehicle aboard, from support pedestals. The loaded crawler then backs out of the Vehicle Assembly Building and transfers the 11.5-million-pound load 3.5 miles to the launch site.

The Crawler has a speed of 1 mile per hour when fully loaded and twice that when unloaded. It can negotiate curves of 500 feet mean radius. A leveling system provides the capability to maintain the entire load in level position during the transfer operation.

The combined weight of the Crawler-Transporter, the Mobile Launcher, and the Apollo/Saturn V exceeds 17 million pounds at the time of transfer from the Vehicle Assembly Building to the launch site. To accommodate this load, a specially constructed Crawlerway was prepared.

The Crawlerway extends from the Vehicle Assembly Building to the launch site, and consists of two 40-foot-wide lanes separated by a 50-foot-wide median strip. The overall width of the roadway is 130 feet or about equal to an eight-lane parkway.

Unsuitable material was removed from the roadbed before beginning construction of the Crawlerway. The area then was compacted with hydraulic fill and selected materials, topped with crushed graded limerock, paved with asphalt, sealed, and covered with gravel, forming a roadbed approximately 7 feet thick. From eight to twelve thousand pounds-per-square foot in surface pressures are exerted on the Crawlerway; this is equivalent to a stress of 40 jetliners landing at the same time on a runway.

The Mobile Servicing Structure is a 402-foot-high tower which weighs 12 million pounds. The structure contains five service platforms that provide circular access to the space vehicle for final servicing at the launch site. The two lower platforms can be adjusted up and down the vehicle, while the three upper platforms have a fixed elevation.

Like the Mobile Launcher, the Mobile Servicing Structure is transported to the launch site by the Crawler-Transporter. It is removed from the pad a few hours prior to launch and returned to its parking area.

Two launch sites are located at Complex 39, three and one-half miles from the Vehicle Assembly Building. Each site is an eight-sided polygon measuring 3,000 feet across.

The major elements of the launch sites include the launch pads; storage tanks for liquid oxygen, liquid hydrogen, and RP-1 propellants; gas compressor facilities; and associated umbilical connection lines necessary for launching the space vehicle.

The launch pad itself is a reinforced concrete hardsite measuring 390 feet by 325 feet. Top elevation of the pad is 48 feet above sea level, sufficient distance for the rocket's engine nozzles to rest above a 700,000-pound flame deflector.

Kennedy Space Center Industrial Area

industrial area

The Industrial Area of the Kennedy Space Center, NASA, nerve center of the Spaceport, is located 5 miles south of Launch Complex 39. The area was planned so that all functions not required at the launch complexes could be grouped for ease of administration and efficient operations. Here, the administrators, scientists, engineers, and technicians plan and accomplish many of the detailed operations associated with prelaunch testing and preparing space vehicles for a mission.

The Headquarters building is the administrative center for spaceport operations. Dr. Kurt H. Debus, Director of the Kennedy Space Center, and his immediate staff maintain offices on the top floors. Procurement, program management, legal, and other support functions occupy lower floors.

The largest structure in the Industrial Area is the Manned Spacecraft Operations building. This facility is used for modification, assembly, and non-hazardous checkout of Apollo spacecraft. It also provides astronaut quarters and medical facilities, spacecraft automatic testing stations and complete supporting laboratories.

Following systems testing in the Fluid Test facilities and Apollo service module static firing at Complex 16, the Apollo spacecraft is delivered to the assembly and test area of this building for integrated systems testing. In the low bay area, individual spacecraft modules undergo non-hazardous acceptance testing, then are mated together and transferred to the high bay area for integrated systems and altitude chamber testing. Two 50-foot altitude chambers environmentally test Apollo spacecraft in conditions simulating altitudes up to 250,000 feet. Space-suited astronauts participate in these simulated flight tests.

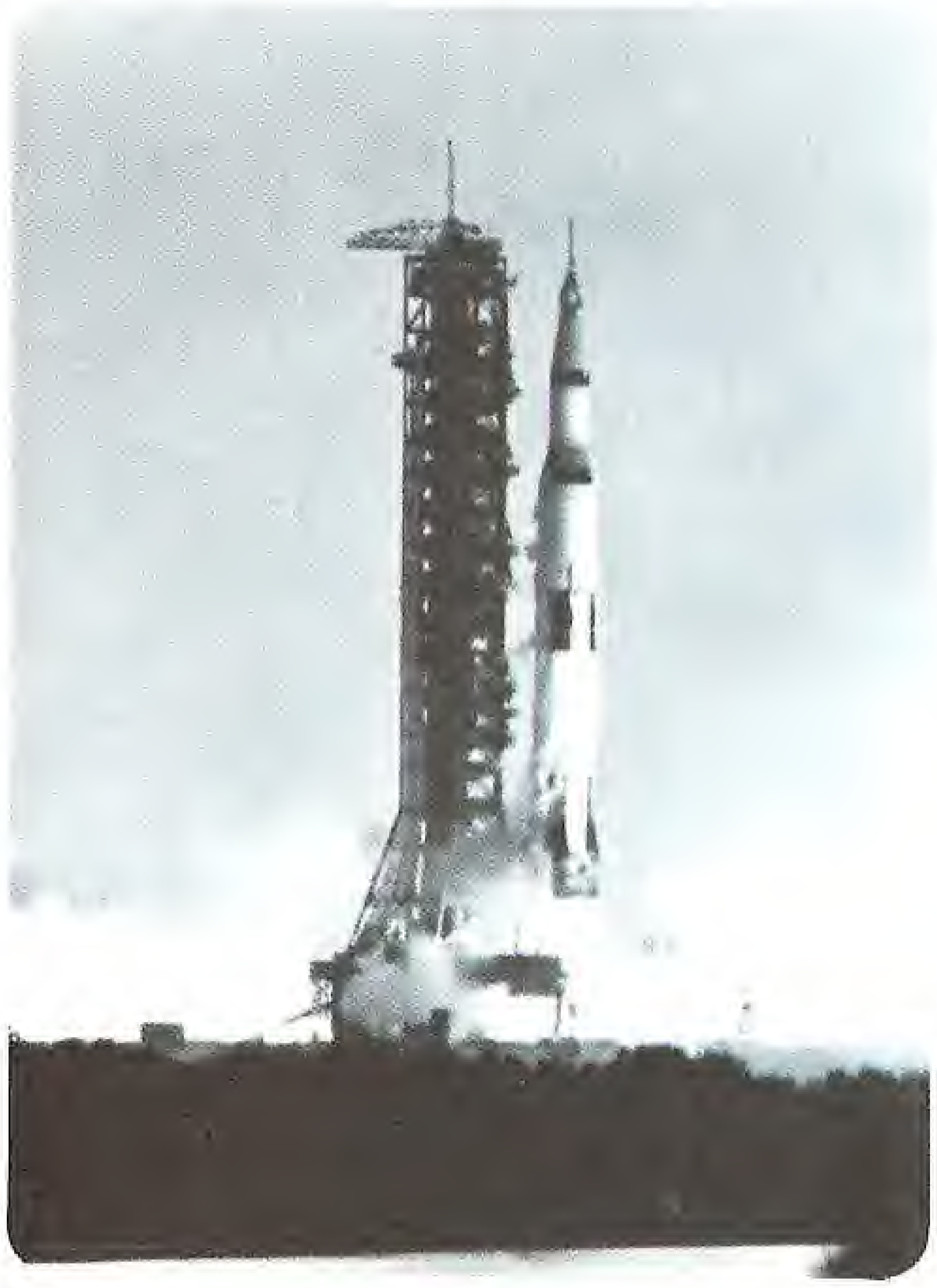
The Information Systems facility is the hub of the Spaceport's instrumentation and data processing operations. It provides instrumentation to receive, monitor, process, display, and record signals and information received from the space vehicle during prelaunch and flight readiness tests, and launch and flight of the space vehicle.

The Industrial Area contains special laboratories and testing facilities for the hazardous checkout operations associated with spacecraft pyrotechnic devices and toxic fluids.

Among the major facilities located in this test area are:

- Life Support Test–this facility is used for high-pressure testing and liquid oxygen supply testing of environmental control systems.
- Fluid Test Support–this facility is a single-story structure housing laboratories, shops, and service areas to support the entire test area. Critical component testing of spacecraft fluid test systems are conducted in the laboratories which maintain special clean-room conditions.
- Hypergolic Test–this facility is used to test and check out stabilization and attitude control systems,orbital maneuvering systems, and reentry control systems for spacecraft. Hypergolic fluids utilized in these systems are especially hazardous since they ignite upon contact with each other.
- Cryogenic Test–this facility is used for checking the cryogenic systems of spacecraft. Cryogenic fluids are supercooled. An example would be liquid hydrogen which must be maintained at a temperature of 423 degrees below zero.
- Pyrotechnic Installation–this ten-story-high facility is used to install spacecraft pyrotechnic devices and to statically weigh and balance the spacecraft in its mission configuration to determine its center of gravity. The facility is also used for optical alignments of critical components of the guidance and navigation systems, as well as acceleration tests on dynamic fixtures.
- Ordnance Storage – this facility provides remote, safe storage for solid fuel motors, pyrotechnic devices, and aligned launch escape towers.
- Parachute Facility – this facility is used to inspect, rig, pack, and store parachutes for manned spacecraft. It contains special humidity control equipment.
- RF Systems Test – this facility is used to adjust, test, and check out spacecraft rendezvous apparatus and procedures in a simulated free space condition. Transmitting antenna height, elevation, squint and azimuth angles, and transmitter frequency are remotely controlled from an operator's console.

Additional support structures in the Industrial Area include cafeteria, warehouses, fire station, security offices, utilities, and occupational health facilities.



the human element

The John F. Kennedy Space Center is many things. It is the tremendous power of space vehicles carrying precious cargoes of men and equipment; it is scientific progress in planning and in action; it is material and hardware—some minute and delicate, some huge and powerful – in various stages of being born and growing up; it is all these . . . and more. The John F. Kennedy Space Center is also people.

From New York City; Nashville, Tennessee; Dallas, Texas; San Jose, California – virtually from all over the United States – these people, representing all racial and ethnic backgrounds and professions and skills, have been molded into one of the greatest teams ever assembled for a peacetime endeavor.

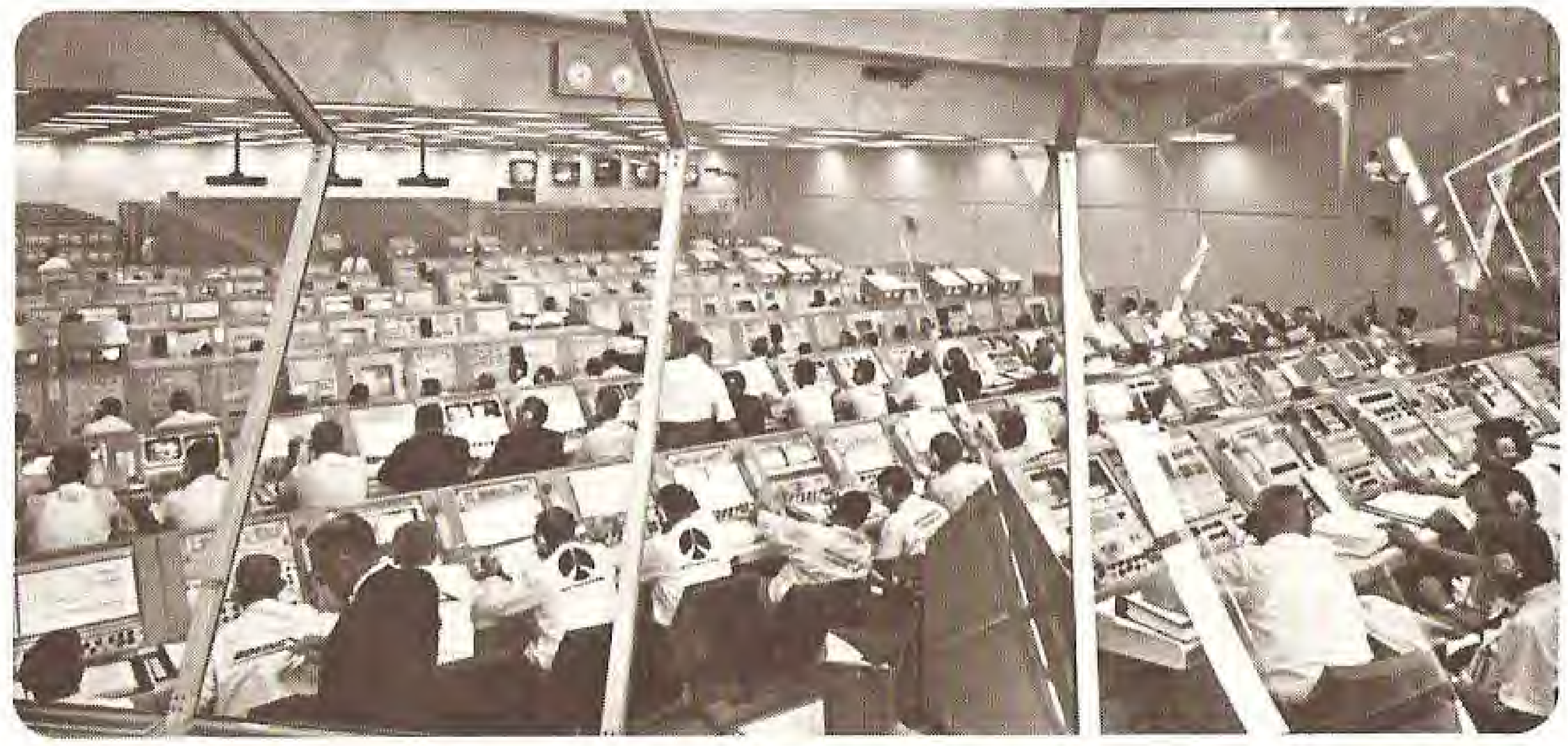
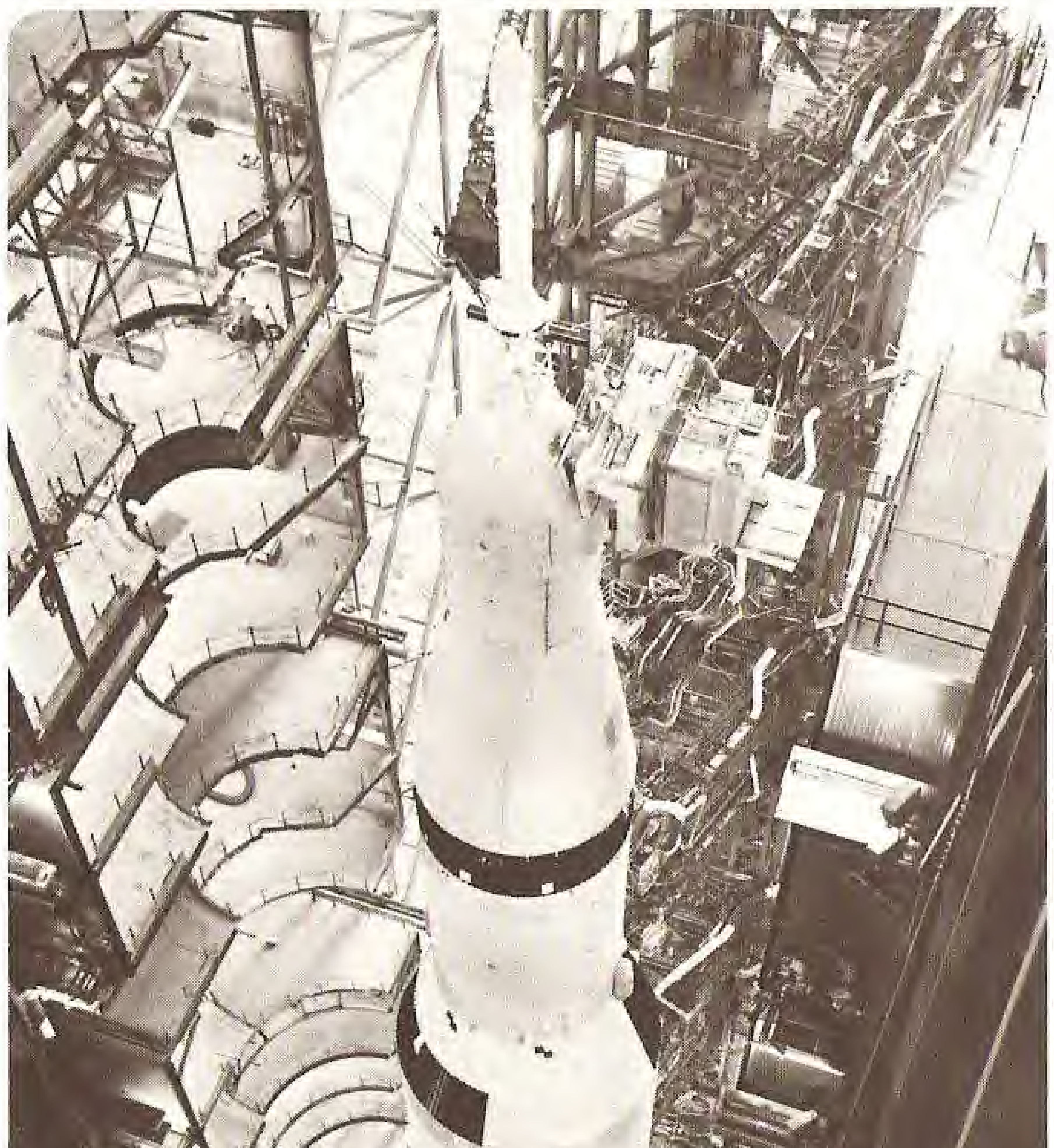
More than 21,000 strong and representing the best launch talent in government and industry, this team devotes its skills and talents to the United States' goal of space preeminence. Additionally, thousands of Air Force Eastern Test Range personnel and Air Force-associated contractor personnel are providing vital range and mission support to NASA activities.

At Cape Kennedy and the national Spaceport, the industrial roll reads like a "Who's Who of American Industry," ranging from the giants of the business world to the smallest companies whose products and services are vital to the overall effort. Working side by side in the buildings, laboratories, blockhouses, and on the launch pads, personnel of these companies, the military, and NASA are forging a common bond of cooperation.

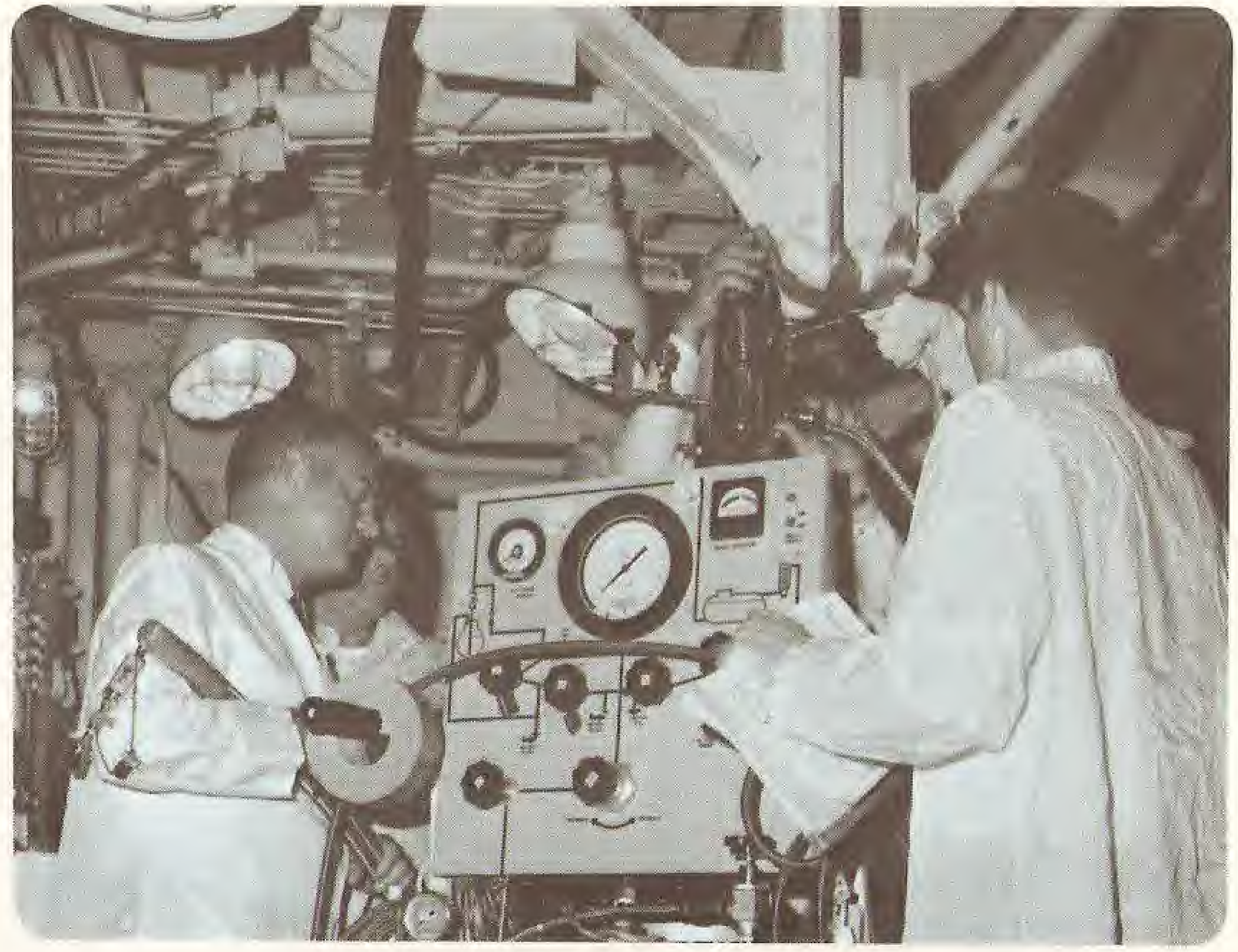
Because the continuing progress of the space program is dependent upon the total, coordinated efforts of many people, no task is inconsequential, no job trivial, and no individual unimportant. Each success hinges on the premise that the people involved will do the best job they know how to do at all times.

The entire space program is varied and complex, as are the skills required to successfully accomplish the job. Welders, radio technicians, doctors of medicine, engineers, scientists, mechanics, tinsmiths, writers, photographers, truck drivers, policemen – all these and more are employed. This is but a fragment of the whole.

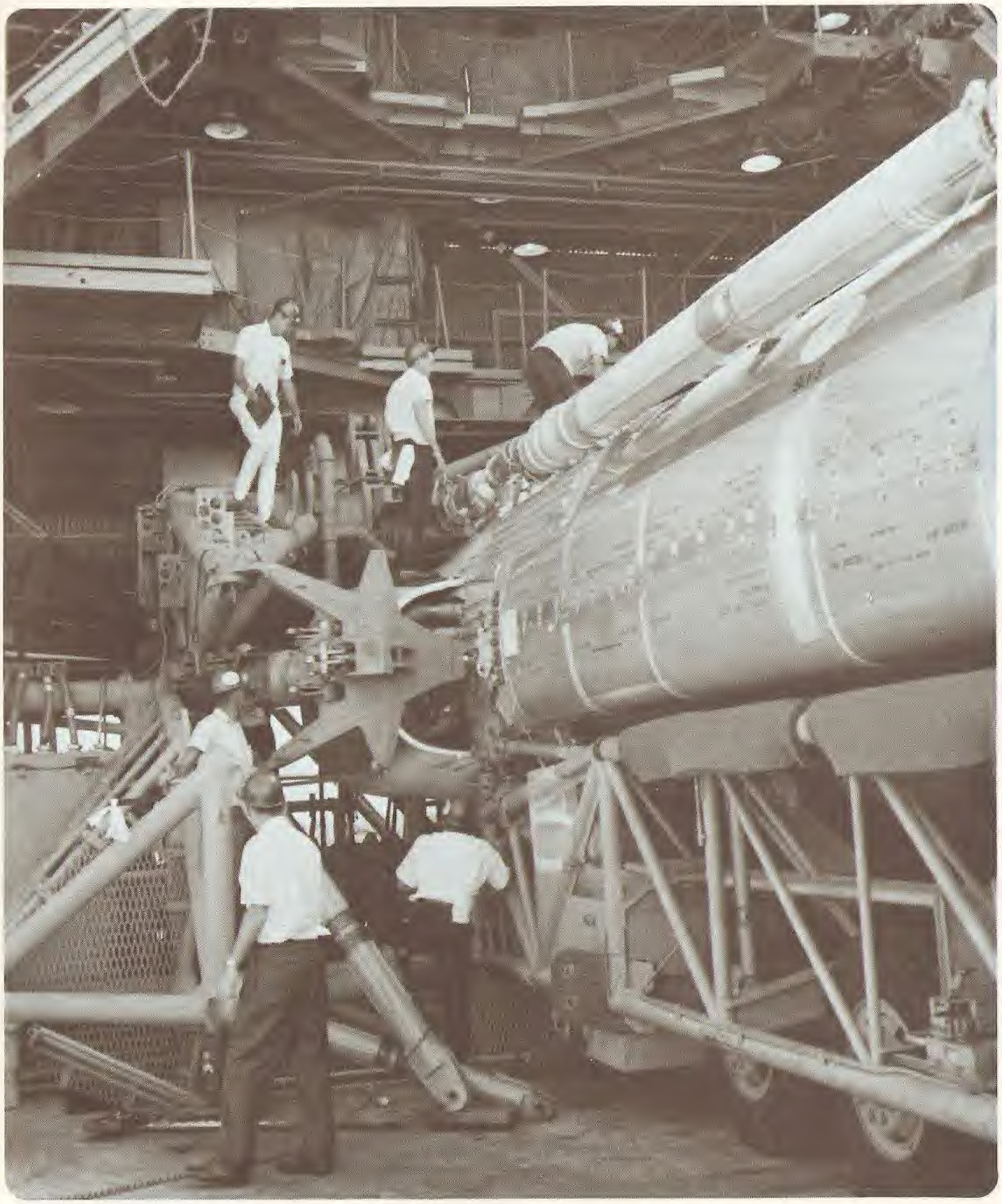
As each day expands the scope and technology of space activities, the need for people who can cope with and contribute to the growth of the space program also expands. People are the most important asset of the program.

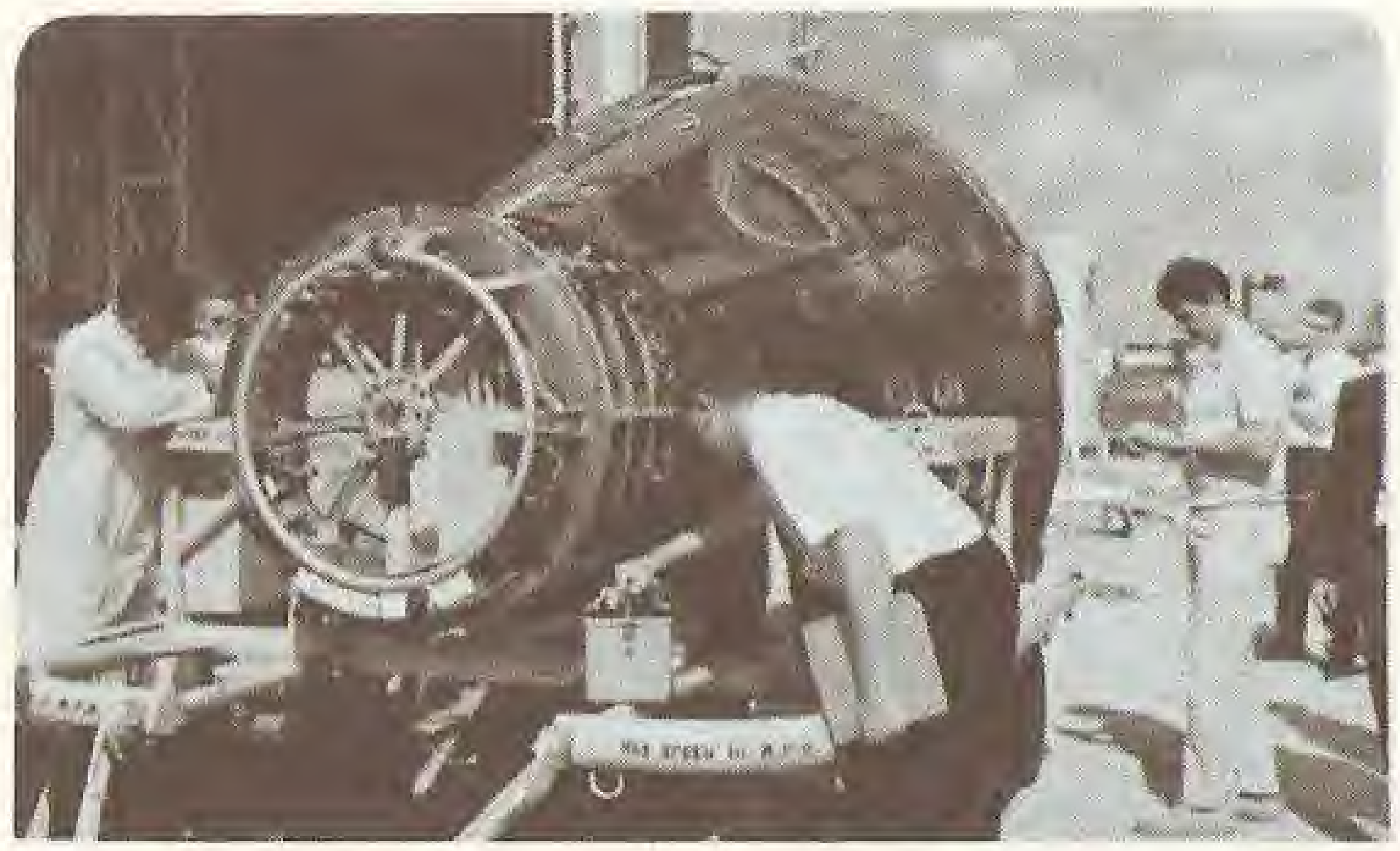





UNITED
STATES




SPACE SCIENCE
DEMONSTRATION
DAILY PRESENTATIONS





where launch team members live

NASA's John F. Kennedy Space Center is more than a launch site for manned and unmanned missions for the peaceful exploration of space. It is a team of men and women – representing government and industry – who participate in NASA's highly successful programs and reside in the surrounding area.

These employees and their families are members of Brevard County's growing communities and are active in the governmental, civic, cultural, educational, religious, and recreational activities.

The area has grown to a community of 200,000 residents extending north and south from the Spaceport. Previously small communities now provide many of the advantages and conveniences inherent to metropolitan areas.

Progress in education has been one of the significant results of the expansion of space activities. The elementary and preparatory school systems rate high by national standards. Approximately 75 percent of their graduates continue education in universities, colleges, and specialized schools.

A privately endowed institution, Brevard Engineering College, offers baccalaurate and advanced degrees in the arts and sciences. State-sponsored Brevard Junior College offers associate degrees in arts and sciences. The State of Florida plans to build a new space age university between the Space Center and Orlando.

University extension programs sponsored by the University of Florida, Florida State University, Rollins College, and the University of Miami enable employees and their families to obtain bachelor's and advanced degrees.

The growing area, with hundreds of miles of ocean and river shore line and many lakes, has retained the major recreational advantages for which it was originally famous. Fishing, sunbathing, surfing, boating, swimming, and water skiing are among the popular sports.

With a 72.5 degree average annual temperature, the area offers an ideal environment for the 21,000 employees and their families who conduct the Kennedy Space Center's programs.

NASA's Manned Flight Log

MERCURY PROGRAM

FLIGHT	ASTRONAUTS	DATE	LIFTOFF	SPLASHDOWN	DURATION
Freedom 7	Alan Shepard	May 5, 1961	9:34 A.M. E.S.T.	9:49 A.M. E.S.T.	:15
Liberty Bell 7	Virgil Grissom	July 21, 1961	7:20 A.M. E.S.T.	7:35 A.M. E.S.T.	:15
Friend-ship 7	John Glenn	Feb. 20, 1962	9:47 A.M. E.S.T.	2:34 P.M. Feb. 20, 1962	4:56
Aurora 7	Scott Carpenter	May 24, 1962	7:45 A.M. E.S.T.	12:31 P.M. May 24, 1962	4:56
Sigma 7	Walter Schirra	Oct. 3, 1962	7:15 A.M. E.S.T.	4:28 P.M. Oct. 3, 1962	9:13
Faith 7	Gordon Cooper	May 15, 1963	8:04 A.M. E.S.T.	6:24 P.M. May 16, 1963	34:27

GEMINI PROGRAM

FLIGHT	ASTRONAUTS	DATE	LIFTOFF	SPLASHDOWN	DURATION
3	Grissom, Young	Mar. 23, 1965	9:24 A.M. E.S.T.	2:16 P.M. Mar. 23, 1965	4:52
4	McDivitt, White	June 3, 1965	10:16 A.M. E.S.T.	12:13 P.M. June 7, 1965	97:57
5	Cooper, Conrad	Aug. 21, 1965	9:00 A.M. E.S.T.	7:56 A.M. Aug. 29, 1965	190:55
7	Borman, Lovell	Dec. 4, 1965	2:30 P.M. E.S.T.	9:05 A.M. Dec. 18, 1965	330:35
6	Schirra, Stafford	Dec. 15, 1965	8:37 A.M. E.S.T.	10:29 A.M. Dec. 16, 1965	25:48
8	Armstrong, Scott	Mar. 16, 1966	11:41 A.M. E.S.T.	10:23 P.M. Mar. 16, 1966	10:42
9	Stafford, Cernan	June 3, 1966	8:39 A.M. E.S.T.	9:00 A.M. June 6, 1966	72:21
10	Young, Collins	July 18, 1966	5:20 P.M. E.S.T.	4:07 P.M. July 21, 1966	70:46
11	Conrad, Gordon	Sept. 12, 1966	9:42 A.M. E.S.T.	8:59 A.M. Sept. 15, 1966	71:17
12	Lovell, Aldrin	Nov. 11, 1966	3:47 P.M. E.S.T.	2:21 P.M. Nov. 15, 1966	94:34

APOLLO PROGRAM

FLIGHT	ASTRONAUTS	DATE	LIFTOFF	SPLASHDOWN	DURATION
7	Schirra, Cunningham, Eisele	Oct. 11, 1968	11:02 A.M. E.D.T.	7:11 A.M. Oct. 22, 1968	260:09
8	Borman, Lovell, Anders	Dec. 21, 1968	7:51 A.M. E.S.T.	10:51 A.M. Dec. 27, 1968	147:00
9	McDivitt, Scott, Schweickart	Mar. 3, 1969	11:07 A.M. E.S.T.	12:01 P.M. Mar. 13, 1969	241.01
10	Stafford, Young, Cernan	May 18, 1969	12:49 P.M. E.D.T.	12:52 P.M. May 26, 1969	192.03
11	Armstrong, Collins, Aldrin, Jr.	July 16, 1969	9:32 A.M. E.D.T.	12:50 P.M. July 24, 1969	195:18
12	Conrad, Jr., Gordon, Jr., Bean	Nov. 14, 1969	11:22 A.M. E.S.T.	3:58 P.M. Nov. 24, 1969	244.36
13	Lovell, Jr. Swigert Haise, Jr.	Apr. 11, 1970	2:13 P.M. E.S.T.	1:08 P.M. Apr. 17, 1970	142:54